ENVIRON

MDA-33S, MONROE DITCH, AND DICKS CREEK REACH 1 SEDIMENT AND FLOODPLAIN SOIL REMEDIATION DESIGN DOCUMENT

Middletown, Ohio

Revision 1

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March 2009

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OHIO RIVER BIOREGION
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CONTENTS

T A B L E S

F I G U R E S

ATTACHMENTS

ACRONYMS

%	Percent
AK Steel	AK Steel Corporation
CAD	Computer aided design
cfs	Cubic feet per second
CM	Coalescing media
COD	Chemical oxygen demand
CQA	Construction quality assurance
CY	Cubic yard(s)
DOF	Dalton, Olmstead, and Fuglevand
DTM	Digital terrain modeling
DQO	Data Quality Objective
EBCT	Empty bed contact time
ENVIRON	ENVIRON International Corporation
EQ	Environmental Quality Company
ft/day	Feet per day
ft/ft	Feet per foot
GAC	Granular activated carbon
gpm	Gallons per minute
gpm/ft^2	Gallons per minute per square foot
GPS	Global positioning system
HASP	Health and Safety Plan
HDPE	High density polyethylene
IESI	Innovative Engineering Solutions, Inc.
IM	Interim Measure
IM SOW	Interim Measures Scope of Work
ISA	Initial separation area
lbs/day	Pounds per day
LLDPE	Linear low density polyethylene

mg/kg	Milligrams per kilogram
mg/L	Milligram per liter
mil	Thousandth of an inch
mm	Millimeter(s)
NAPL	Non-aqueous phase liquids
NPDES	National Pollution Discharge Elimination System
NRDC	Natural Resources Defense Council
NTU	Nephelometric turbidity units
NWP	Nationwide permit
ODNR	Ohio Department of Natural Resources
OEPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
oz	Ounces
PCB	Polychlorinated biphenyl
PID	Photo-ionization detector
PIP	Public Involvement Plan
PPE	Personal protective equipment
PTE	Potential to Emit
PTI	Permit to Install
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance Project Plan
QHEI	Qualitative Habitat Evaluation Index
RAO	Remedial action objectives
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RFQ	Request for qualifications
RTK-GPS	Real Time Kinematic Global Positioning System
SOP	Standard operating procedure
SVOC	Semi-volatile organic compound

SWMU	Solid waste management units
SWP3	Stormwater pollution prevention plan
TDI-BI	TDI Brooks International Incorporated
TOC	Total organic carbon
TPH	Total petroleum hydrocarbon
TIN	Triangulated irregular network
TSCA	Toxic Substance Control Act
μg/L	Microgram per liter
United States et al.	United States, State of Ohio, Sierra Club, NRDC
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile organic compound

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1.0 INTRODUCTION

On behalf of AK Steel Corporation (AK Steel), ENVIRON International Corporation (ENVIRON), Dalton, Olmsted, and Fuglevand (DOF), Innovative Engineering Solutions, Inc. (IESI), and Biohabitats prepared this report to address the design details and specifications necessary to implement remediation activities associated with Interim Measures (IMs) 2, 3, 4.C, 6, and 8 of the Consent Decree Interim Measures Scope of Work (IM SOW). The purpose of this design report is to document the overall design approach, design basis, procedures, and activities for the IMs. As appropriate, discussions within this design report reference the Technical Specifications (Attachment 1) and design drawings (Attachment 2). This Design Document has been prepared in accordance with the Consent Decree signed by United States et al. (i.e., United States, the State of Ohio, Natural Resources Defense Council [NRDC], and Sierra Club) and AK Steel and entered on May 15, 2006 (Case Number C-100530).

This Design Document addresses the design detail and specification necessary to implement remediation activities associated with:

- IM 2: Excavation of floodplain soil;
- IM 3: Soil excavation and groundwater containment and treatment system in the vicinity of MDA-33S;
- IM 4.C: Excavation of soils in the vicinity of United States Environmental Protection Agency (USEPA) floodplain soil samples S25/S28 located near MTR Martco on the south side of Dicks Creek;
- IM 6: Excavation of sediment and other materials in Monroe Ditch, Outfall 002 Channel and Dicks Creek Reach 1; and
- IM 8: Restoration of Reach 1, Outfall 002 Channel, and Monroe Ditch.

These activities are currently planned as 2009 remedial actions[1].

This document describes the design elements, remedial action objectives (RAOs); site preparation; excavation, dewatering, transport, and disposal of soils and sediment; and RAO verification, monitoring, and contingency planning. All design specifications have been developed in accordance with applicable USEPA and Ohio Environmental Protection Agency (Ohio EPA) requirements, regulation, guidance, and technical standards.

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[1] IM 4.B (excavation of floodplain soils in the vicinity of USEPA floodplain soil sample S23) and IM 7 (excavation of sediment and other materials in Dicks Creek Reach 2) will be addressed in a separate design report. The Reach 2 remedial action, as well as the remediation of any remaining portion of Reach 1 not remediated in 2009 is currently planned for 2010.

The remediation area for IM 2 (Reach 1 floodplain soil excavation) also includes the remediation areas for IM 4.C (soils in the vicinity of USEPA floodplain soil samples S25/S28) and the Outfall 002 Channel. All discussions in this Design Document for IM 2 (Reach 1) will be inclusive of IM 4.C and Outfall 002 Channel, unless specifically excluded.

1.1 Site Location and Description

The AK Steel Middletown Works facility is located in southwestern Ohio, in Butler County, in the city of Middletown. The entire facility covers an area of approximately 2,600 acres and is involved in various aspects of iron and steel manufacturing and processing. The slag processing area is an approximately 100-acre parcel south of the AK Steel facility proper and southeast of the Oxford State Road/Yankee Road intersection. This property is owned by AK Steel and leased to and operated by Tube City IMS Corporation (formerly OMS).

Dicks Creek is a small, partially channelized stream draining an urbanized and industrialized watershed of approximately 31,200 acres (Childress 2001). It is located to the south and east of Middletown, Ohio, in Butler and Warren Counties (Figure 1-1). Dicks Creek originates to the east of Middletown and flows westward toward its confluence with the Great Miami River. The Dicks Creek watershed extends approximately 12 miles east of the Great Miami River and drains an area of approximately 50 square miles. Significant tributaries include the north branch of Dicks Creek (which flows from north to south adjacent to the AK Steel facility before joining the main branch of Dicks Creek), Shaker Creek, and Miller's Creek (which flows into Shaker Creek a short distance upstream of its confluence with Dicks Creek). A portion of Dicks Creek flows between the AK Steel plant and the slag processing area. AK Steel owns the land surrounding and underlying those portions of Dicks Creek between approximately river miles 2.5 and 5.6.

For remediation planning purposes, two reaches have been designated in Dicks Creek. Reach 1 includes the channelized portion of the creek on and near AK Steel property, extending from approximately 50 feet upstream of Outfall 002 (Station 168+10) to approximately 400 feet downstream of Yankee Road (Station 133+10). Reach 1 is approximately 3,500 feet in length along the centerline. Reach 2 starts at the downstream end of Reach 1 and extends downstream approximately 7,270 feet to Station 50+40. As mentioned above, remediation work to be conducted in 2010 (Reach 2 and portions of Reach 1) will be addressed under separate cover. The 2009 floodplain and sediment remediation areas of Reach 1 and Monroe Ditch that are addressed in this document are shown in Figure 1-2.

Of the six permitted outfalls that discharge to Dicks Creek from the AK Steel facility, only Outfall 002 discharges within the IM remediation area. Outfall 002 discharges to Dicks Creek through a short drainage channel that is incised into the floodplain terrace on the north side of Dicks Creek near station 166+15 in the northwestern portion of the IM remediation area.

Monroe Ditch is a small Dicks Creek tributary that drains the southwestern portion of the slag processing area and mixed use agricultural land upstream of the slag processing area. The entire length of Monroe Ditch drains an approximately 1,800-acre watershed. Monroe Ditch originates near State Route 63 and flows north to the Tube City IMS Area. Monroe Ditch enters the southwestern portion of the slag processing area through three culvert pipes that run beneath the railroad tracks near the southern property line at approximately river mile 0.6. This 3,300-foot stretch from the three culverts to Dicks Creek is included in the IM remediation area. Within the Monroe Ditch IM remediation area, the ditch flows between two existing landfills and then alongside an embankment supporting railroad tracks prior to joining Dicks Creek at station 146+40, east of Yankee Road and the railroad bridge.

Monitoring Well MDA-33S (Figure 1-1) is located along the west bank of Monroe Ditch, adjacent to the solid waste landfill (Solid Waste Management Unit [SWMU] 39). MDA-33S is located at the transition between the mowed landfill and an approximately 5-foot to 10-foot riparian corridor immediately adjacent to Monroe Ditch. Due to its close proximity to Monroe Ditch, remediation design and implementation for MDA-33S and Monroe Ditch will be coordinated.

1.2 Site Background

Concerns were first raised regarding polychlorinated biphenyls (PCBs) in Dicks Creek in 1995 after the Ohio EPA identified PCBs in sediment in Dicks Creek (Ohio EPA 1997). Samples subsequently collected by Ohio EPA from groundwater seeps entering Monroe Ditch were analyzed in November 1997 and demonstrated the presence of PCBs. Following sampling activities to identify the source of PCBs to Dicks Creek, AK Steel installed a groundwater interceptor trench system along the eastern bank of Monroe Ditch. The interceptor trench was completed in mid-January of 1998 and was later extended to intercept an additional seep.

The *Soil and Groundwater Investigation Report* (ARCADIS 2002) provides a detailed description of historical operations and potential sources of PCBs in the slag processing area. In brief, PCBs are present due to the historical use of PCB-containing oils in equipment used at the plant. Three former oil separator ponds located in the slag processing area were found to contain PCBs and were closed circa 1983. PCBs have since been detected in soil at some locations in the area.

Environmental media in and near Dicks Creek, Monroe Ditch, and the Outfall 002 Channel have been extensively sampled by AK Steel, USEPA, and Ohio EPA. Investigative activities and the resulting data are described in detail in the *Soil and Groundwater Investigation Report (*ARCADIS 2002). Additional sampling and analysis work was performed under the *Floodplain Soil Sampling and Analysis Plan* (ENVIRON 2005a), the *Phase II Floodplain Soil Sampling and Analysis Plan* (ENVIRON 2006a), the *Floodplain Soil Supplemental Sampling Plan* (EVIRON 2007a), the *Upland Sources Sampling and Analysis Plan, Revision 4* (ENVIRON 2007b) and the *Sediment Delineation Sampling and Analysis Plan, Revision 2* (ENVIRON 2005b). The results of the studies conducted under these work plans are described in Section 3.

1.3 Site Geology and Hydrogeology

The site geology and hydrology has been extensively studied and described by prior studies (ARCADIS 2002) as summarized below.

Middletown is located in the glaciated portion of Ohio. In this portion of the state, bedrock is overlain by unconsolidated glacial deposits, which are primary the groundwater-bearing units. In the Middletown area, bedrock is the Richmond Group (Ordovician), which consists of inter-bedded fossiliferous limestone and calcareous shale. These rocks were formed in a shallow sea in a tropical environment. Outcrops of these rocks are visible, for example, in a bluff along a set of railroad tracks located southeast of the slag processing area.

This portion of southwestern Ohio is considered part of the Eastern Corn Belt Plain and more specifically, the loamy high lime till plain (Brockman 2005; Debrewer et al. 2000). Surficial deposits in this area consist of predominately silty and clayey lake deposits, with some outwash deposits along rivers and floodplains (Debrewer et al. 2000).

The stream banks throughout Dicks Creek are highly variable. In some places the banks are very steep; in other places, banks are nearly horizontal. In most cross sections, the bank elevations are closely related to the adjacent land use (e.g., landfills, railroads). Portions of Dicks Creek have banks which have eroded or have experienced mass wasting and slumping. These areas showed no relationship to groundwater seep locations; rather these areas of mass wasting and slumping appear to be related to the altered channel morphology.

Dicks Creek is approximately 40 feet wide and typically 2 feet deep during normal flow conditions. In Reach 1, the Dicks Creek floodplain is approximately 180 feet wide with levees or dikes on both sides. It has been filled during the past 35 years by unconsolidated, fluvial sediment deposits. The morphology of the floodplain has been shaped by past channel modifications. In the 1960s, this area of Dicks Creek was channelized as part of the Miami Conservancy District flood control program. The channelization process involved widening, deepening, and straightening the natural channel of Dicks Creek and rerouting the north branch of Dicks Creek to its current course. As a result of channelization, sediment rapidly filled the excavated trapezoidal channel of Dicks Creek, creating an abbreviated floodplain, through which a narrower stream channel became incised (i.e., the existing low-flow channel). Consequently, the floodplain is now terraced in this portion of Dicks Creek. Historically the floodplain between the dikes was mowed as a maintained meadow until about five years ago.

Within the remediation area, Monroe Ditch is typically 10 feet wide with water depth ranging from three inches to greater than two feet. This portion of Monroe Ditch is bounded by closed solid waste landfills, active mill scale and slag processing areas, and a rail line. Monroe Ditch is generally bordered by steep slopes rising up from the ditch to the landfills or railroad tracks located adjacent to the ditch. These steep slopes limit access to the area to be remediated.

2.0 REMEDIAL ACTION OBJECTIVES AND PERFORMANCE

The RAOs and relevant performance criteria for each IM addressed in this design document are presented below.

2.1 Interim Measures 2 and 4.C: Excavation of Floodplain Soil Dicks Creek Reach 1

The floodplain area includes both soils and sediment that are not directly located in the currently existing Dicks Creek stream channel. All floodplain soil and sediment is collectively referred to as soil, herein.

2.1.1 Remedial Action Objective

The RAO for IMs 2 and 4.C is the excavation and proper disposal of any floodplain soil from Dicks Creek that exceeds the Action Level (i.e., floodplain soil cleanup goal) of 5 milligrams per kilogram (mg/kg) of total PCBs.

2.1.2 Remedial Action Performance Criteria

The performance criteria from the IM SOW include:

- Removal and segregation of Dicks Creek floodplain soils determined *in situ* to exceed 50 mg/kg dry weight, as regulated by the Toxic Substances Control Act (TSCA) and Title 40 of the Code of Federal Regulations at Part 761.61(c) (40 CFR Part 761.61(c));
- Removal and segregation of Dicks Creek floodplain soils in the vicinity of S25/S28 that contain free product;
- Removal of Dicks Creek floodplain soils containing more than the 5 mg/kg total PCBs floodplain soil Action Level;
- Satisfaction of Design Document specifications through the measurement of excavation depths and dimensions;
- Satisfaction of post-remediation confirmatory sampling requirements;
- Disposal of floodplain soil between 5 mg/kg and 50 mg/kg dry weight at an approved landfill;
- Disposal of floodplain soil which exceed 50 mg/kg dry weight (*in situ*) in a TSCA-approved landfill; and
- Restoration of the S25/S28 (IM 4.C) excavated area with clean fill and native vegetation or clean fill and gravel, as applicable.

The RAO has been achieved once these remedial action performance criteria are satisfied.

2.2 Interim Measure 6: Excavation of Sediment and other Material in Monroe Ditch, Dicks Creek Reach 1 and Outfall 002 Channel

2.2.1 Remedial Action Objective

The RAO for IM 6 is the removal and proper disposal of sediment and other materials, as well as any clay or other native material, from Outfall 002 Channel and Dicks Creek that exceeds the Action Level (i.e., sediment cleanup goal) of:

- The spatially averaged residual concentration of 1.5 mg/kg dry weight total PCBs for Reach 1 and Outfall 002 channel; and
- 3 mg/kg dry weight total PCBs for any sample.

2.2.2 Remedial Action Performance Criteria

The sediment areas have been characterized to delineate the extent of removal required to meet the performance criteria from IM SOW:

- Removal and segregation of sediment determined *in situ* to exceed 50 mg/kg dry weight, as regulated by TSCA and 40 CFR Part 761.61(c);
- Removal of sediment (sand or finer);
- Removal of any underlying clay or other native material exceeding the spatially weighted average concentration of 1.5 mg/kg total PCBs or the individual concentration of 3 mg/kg total PCBs;
- Satisfaction of Design Document specifications through the measurement of excavation depths and dimensions;
- Disposal of sediment, clay, or other native materials between 5 mg/kg and 50 mg/kg dry weight at an approved landfill; and
- Disposal of sediment, clay, or other native materials which exceed 50 mg/kg dry weight (*in situ*) in a TSCA-approved landfill.

The required elevation of removal has been established in the sediment remediation areas based on the results of the previously performed site characterization. Remedial performance will be based on removal of material to the elevations established during the delineation process. No confirmatory sampling is to be performed in sediment areas except near DC1-SC17A[2]. In sediment removal cells, confirmation testing will be based on post-excavation elevation being at or below the design elevation in that cell. The RAO has been achieved once these remedial action performance criteria are satisfied.

[2] Confirmatory sampling at DC1-SC17A is included with the conditions for approval of the *Data Summary Report: Sediment Delineation*. Confirmatory sampling for remediation grid cells associated with DC1-SC17A will be conducted in accordance with the floodplain soil confirmatory sampling procedures.

2.3 Interim Measure 3: MDA-33S Remediation

2.3.1 Remedial Action Objective

The RAO for IM 3 is to prevent further discharges of free product, PCBs, and other contaminants of concern to Monroe Ditch[3]. Soil and sediment adjacent to and below Monroe Ditch are impacted with PCBs which discharged from the adjacent closed landfill located west of the ditch.

2.3.2 Remedial Action Performance Criteria

The performance criteria from the IM SOW include:

- The installation of a containment barrier to the depth and length specified in the Design Document to contain free product;
- The installation and operation of a free product and associated PCB contaminated groundwater containment and recovery system to prevent the migration of free product associated with MDA-33S and associated PCB contaminated groundwater into Monroe Ditch;
- The installation and operation of a treatment system to remove PCBs dissolved in groundwater and prevent the migration of PCBs associated with MDA-33S into Monroe Ditch; and
- The installation and monitoring of sentinel wells beyond the extent of the barrier to verify that free product and other contaminants of concern are contained.

The RAO has been achieved once these remedial action performance criteria are satisfied.

2.4 Interim Measure 8: Restoration of the Outfall 002 Channel, Dicks Creek Reach 1, and Monroe Ditch

2.4.1 Remedial Action Objective

The RAO for IM 8 is the restoration of the Outfall 002 Channel, Dicks Creek Reach 1, and Monroe Ditch. This RAO can be assessed at the time of construction completion.

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[3] The IM SOW calls for IM 3 to address free product migration and IM 8 to address the movement of contaminants from the adjacent areas into Monroe Ditch. The IM 8 objective was originally intended to be addressed by an in-stream impervious synthetic liner. However, AK Steel in consultation with USEPA et al., determined that the liner and underdrain collection and treatment system associated with IM 8 were impracticable and could be better addressed as part of the MDA-33S groundwater containment and treatment system (IM 3). Therefore, the potential migration of free product and other contaminants are included as part of the IM 3 remedial action objective.

2.4.2 Remedial Action Performance Criteria

The performance criteria from the IM SOW[4] include:

- Installation of riprap in the Outfall 002 Channel to restore elevation to pre-existing grade;
- Placement of backfill consisting of at least 1 foot of clean material in areas where 1 or more feet of sediments have been removed in Dicks Creek Reach 1;
- Minimize down-cutting or under-cutting of the stream;
- Placement of clean substrate (e.g., sand, gravel, and cobble) to minimize channel incision and provide habitat for ecological communities in Reach 1 and Monroe Ditch;
- Restore biological productivity in Monroe Ditch and Dicks Creek Reach 1 to the maximum extent practicable and develop Qualitative Habitat Evaluation Index (QHEI), Invertebrate Community Index (ICI), and Index of Biotic Integrity (IBI) scores at or exceeding the greater of pre-remediation conditions or upstream (undisturbed area) values; and
- Satisfaction of Design Document specifications through the measurement of backfill material.

The RAO has been achieved once these remedial action performance criteria are satisfied.

[4] As described above, the performance criterion related to limiting migration of contaminants into Monroe Ditch will be addressed under IM 3 rather than IM 8.

3.0 DATA QUALITY OBJECTIVES

As described by the USEPA (2006), the Data Quality Objectives (DQOs) Process is applicable to all programs involving the collection of environmental data intended to support decision making. The DQO Process achieves this by applying systematic planning and statistical hypothesis testing methodology to decide between alternatives. The DQO Process, initiated for each IM in the *Interim Measures Remediation Work Plan, Revision 2* (ENVIRON 2008b), followed the seven-step program designed to ensure that data collection was resource effective while meeting the objectives of the study. An extension (and re-evaluation) of this Process was continued, as outlined below, during the current remedial design phase for: (1) floodplain soil remediation and restoration in Reach 1 of Dicks Creek; (2) sediment remediation and restoration in Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch; and (3) free product containment and recovery and groundwater treatment in the vicinity of MDA-33S. To facilitate access to the data collected in accordance with the DQO Process, key elements are presented in Attachment 3. A final evaluation of this Process is presented in Section 3.4.

3.1 Floodplain Soil Remediation

Components of the remediation and restoration of floodplain soil in Reach 1 of Dicks Creek are tied into multiple IMs:

- IM 2 (excavation and proper disposal of floodplain soils containing more than 5 mg/kg of total PCBs); and
- IM 4.C (delineation, excavation, and proper disposal of soils containing more 5 mg/kg of total PCBs in the vicinity of S25/S28.

Below, related elements of these IMs are examined in conjunction through the DQO Process.

3.1.1 State the Problem

PCBs have been historically identified in the floodplain soil of Dicks Creek and pose a potential threat to human health and the environment. Under the IM SOW, AK Steel has identified:

- The horizontal and vertical extent of PCB contamination within the floodplain of Dicks Creek; and
- The horizontal and vertical extent of PCB and free product contamination in the vicinity of USEPA floodplain soil sample S25/S28.

The IM SOW further requires AK Steel to remove the contaminated soil therein.

Using the DQO Process, a planning team was developed consisting of the AK Steel Project Manager, the AK Steel Project Coordinator, the ENVIRON Project Manager, and supporting ENVIRON technical staff (i.e., chemists, geologists, engineers, and quality assurance specialists). The duties of the team members have been discussed in the

Interim Measures Quality Assurance Project Plan (QAPP) (ENVIRON 2006b). The decision maker for the DQO planning team is the AK Steel Project Manager, and all decisions must be formally approved by United States et al. All activities associated with IMs 2 and 4.C must be consistent with the terms of the Consent Decree. In addition, IM 2 requires access agreements from impacted property owners and all necessary permits.

3.1.2 Identify the Goals of the Study

The overall goals of IMs 2 and 4.C are the excavation and proper disposal of any Dicks Creek floodplain soil exceeding the Action Level (i.e., the IM 2 cleanup goal). The investigation conducted under the *Floodplain Soil Sampling and Analysis Plan* (ENVIRON 2005a) provided the initial data necessary to delineate the extent of PCBs exceeding the Action Level throughout the Dicks Creek floodplain (including the vicinity of USEPA soil sample S25/S28). After identifying multiple hot spots during the initial investigation, a more intensive investigation focused on these hot spots was initiated, as detailed in *Phase II Floodplain Soil Sampling and Analysis Plan* (ENVIRON 2006a) and later in *Floodplain Soil Supplemental Sampling Plan* (ENVIRON 2007a). Data acquired during these three investigations were used to design the excavation and disposal of all floodplain soil that exceeds the Action Level (see Section 3.1.5). No action is required in areas determined to be below the Action Level.

3.1.3 Identify Information Inputs

Analytical data for total PCB concentration served as the primary input into the decision making process for IMs 2[5] and 4.C; observational data, relating the presence of free product, also served as an input into the decision making for IM 4.C. These decisions were controlled by the Action Level (see Section 3.1.5) which has been agreed upon in the IM SOW (Attachment 1 of the Consent Decree) by United States et al. and AK Steel.

The *Floodplain Soil Sampling and Analysis Plan* (ENVIRON 2005a), *Phase II Floodplain Soil Sampling and Analysis Plan* (ENVIRON 2006a), and *Floodplain Soil Supplemental Sampling Plan* (ENVIRON 2007a) were approved by United States et al. and these investigations were conducted in accordance with the approved *Interim Measures QAPP* (ENVIRON 2006b) and addenda. Soil samples, located on United States et al.-approved strategic sampling grids/transects, were collected by direct push methods (i.e., Geoprobe®, hand auger). The samples collected under the *Floodplain Soil Sampling and Analysis Plan* (ENVIRON 2005a) and the *Phase II Floodplain Soil Sampling and Analysis Plan* (ENVIRON 2006a) were analyzed for PCB homologues by TDI Brooks International Incorporated (TDI-BI)[6] according to USEPA Method 680 (TD-BI 2005; USEPA 1985). The samples collected under the *Floodplain Soil Supplemental*

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[5] PCB analytical data used in the decision making for IM 2 was collected under IM 1.

[6] A performance evaluation audit of TDI-BI was completed by the USEPA and is available in the approved *Data Summary Report: Floodplain Soil (March 7 – June 15, 2005)* (ENVIRON 2005c).

Sampling Plan (ENVIRON 2007a) were analyzed for PCBs using Hybrizyme PCB immunoassay test kits (USEPA Method 4020) and a subset were verified by analyzing for PCB homologues by TDI-BI using USEPA Method 680. The detection levels associated with both methods were well below the Action Level. Results of analyses were reported in the approved *Data Summary Report: Floodplain Soil (March 7 – June 15, 2005)* (ENVIRON 2005c), *Data Summary Report: Phase II Floodplain Soil* (ENVIRON 2006c), and *Data Summary Report: Phase III Floodplain Soil (October 9 – December 20, 2007)* (ENVIRON 2008a). Additionally, total PCB data collected and/or analyzed by USEPA (2003, 2005, 2008a) were incorporated into the decision making process. PCB-Aroclors were analyzed according to USEPA Method 8082 at the USEPA Region 5 Central Regional Laboratory. Together, these data sets will be used to direct decisions.

3.1.4 Define the Boundaries of the Study

The target population for IMs 2, and 4.C consisted of continuous media (i.e., Dicks Creek floodplain soil). However, prior to the study, the preliminary boundaries of the investigation were visually delimited in Attachment 6 of the Consent Decree. The target population was defined by both temporal and spatial boundaries. The temporal boundaries of the target population included all floodplain soil samples collected by the USEPA in 2003 and 2005 and by AK Steel during the years 2005 through 2008 (ENVIRON 2005a, 2006a, 2007a) as presented in the *Data Summary Report: Floodplain Soil (March 7-June 15, 2005)* (ENVIRON 2005c), *Data Summary Report: Phase II Floodplain Soil* (ENVIRON 2006c), and *Data Summary Report: Phase III Floodplain Soil* (ENVIRON 2008a). The spatial boundaries of the target population were focused on Reach 1 of Dicks Creek, which includes the channelized stretch of Dicks Creek extending from approximately 50 feet upstream of Outfall 002 to approximately 50 feet downstream of the former United States Geological Survey (USGS) gauging station downstream of Yankee Road. Generally, the northern and southern boundaries of the channelized Reach 1 floodplains were defined by Dicks Creek and the adjacent levees. The depths of the floodplains relevant to this study had not been formally defined, but were limited in areas by a concrete liner associated with the Norfolk Southern railroad bridge[7].

USEPA floodplain soil location S25/S28 is located within Reach 1 of Dicks Creek. The spatial boundaries of S25/S28 were less clearly defined. While visually delimited in Attachment 6 of the Consent Decree, the horizontal extent of this portion of Reach 1 was not formally defined by physical boundaries in all directions. Although limited to north-south between Dicks Creek and the levee, this area was not limited to the west or east.

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[7] The concrete liner armors and channelizes the path of Monroe Ditch and Dicks Creek in the vicinity of the railroad bridge. The Miami Conservancy District, in *Review of Modified Partial Plan Number One: Dicks Creek Channel*, references this concrete channel lining provided for the Conrail (Norfolk Southern) crossing during the channel improvement project conducted circa 1967 (Rinehart,1983). This concrete liner armors the current confluence from meandering and prevents erosion of the bridge footers. All material above the concrete liner will be removed during the IMs activities.

The depth of the floodplain relevant to S25/S28 was proposed as the concrete liner associated with the Norfolk Southern railroad bridge and the confluence of Monroe Ditch with Dicks Creek.

A sampling unit from this target population corresponded to each single floodplain soil sample, homogenized and sub-sampled from a discrete depth interval of soil from each sample location. Together, adjacent sampling units were used to establish the bounds of decision units. Thus, each decision unit corresponded to the three-dimensional volume of soil surrounding and represented by a single sampling unit. The decision rules (see Section 3.1.5) were used to determine whether each decision unit is excavated and restored or left in place. [8]

3.1.5 Develop the Analytical Approach

The IM SOW specifies soil cleanup standards and so this concentration became the Action Level. Thus, the decision rule is as follows:

> *If a soil sampling unit contains more than 5 mg/kg of total PCBs (and/or free product [IM 4.C]), then the decision unit encompassing the soil sampling unit (i.e., all soil within the three-dimensional remediation footprint) will be excavated and properly disposed.*

Generally, each sample location was represented by a single sampling unit. However, if multiple analyses occurred at one sampling location (e.g., duplicate samples, sample dilution, reanalysis), then the maximum detected value was considered for the remediation design. AK Steel considered qualified estimated results in excess of the cleanup criteria in the remedial design.

3.1.6 Specify Performance or Acceptance Criteria

Since the sampling and analytical approach could only estimate the true condition of the floodplain soil, an incorrect decision (i.e., decision error) could potentially have been made if erroneous data were used. Sources of error associated with the data set used for decision making may have existed due to inherent variability in the sample collection and analytical processes.

The two main components of total study error include sampling error (i.e., sampling design does not take into account the amount of variability within the media) and measurement error (i.e., inherent errors associated with sample collection, handling, preparation, analysis, and data reduction). Sampling error was reduced through use of a

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[8] The distal bounds of decision units could not be established in two distinct areas of Reach 1 of Dicks Creek. This includes an area of the northern floodplain, upstream of the Norfolk Southern railroad bridge (i.e., R1Z1B-T7F) and an area of the southern floodplain, immediately east of the phytobarrier (IM 12) (i.e., R1Z6-T8E, R1Z6-T9E, R1Z6-T10E, and R1Z6-T11D). Since the lateral bounds of these decision units extend beyond the floodplain levee, these areas will be incorporated into the Additional Areas under the RCRA Facility Investigation (Attachment 2 of Consent Decree,).

strategic phased sampling investigation (see Section 3.1.3). Measurement error was minimized through the strict adherence to approved field and laboratory standard operating procedures (SOPs) and through the evaluation of data quality indicators described in the *Interim Measures QAPP* (ENVIRON 2006b) including precision, accuracy, representativeness, completeness, comparability, and conformance with reporting limits and/or estimated quantitation limits.

Two types of decision errors are common in environmental measurements. False rejection errors (i.e., Type I errors or false positives) can occur when the data suggests that the baseline condition does **not** exist when, in fact, it does exist (e.g., determining that a contaminated sample is not contaminated, thus requiring no remediation of the associated decision unit). False acceptance errors (i.e., Type II errors or false negatives) can occur when the data suggests that the baseline condition does exist when, in fact, it does **not** exist (e.g., determining that a non-contaminated sample is contaminated, thus requiring remediation of the associated decision unit). In order to be conservative, only false rejection errors were considered since the error could result in human health and/or ecological impacts.

For the purposes of IMs 2 and 4.C, decision units surrounding contaminated sampling units were determined and are targeted for excavation. Decision units targeted for excavation correspond to the soil within the three-dimensional remediation footprint surrounding any sampling unit that exceeded the Action Level. The vertices of the remediation footprint were developed from the surrounding sampling units that fell below the Action Level. Thus, as the remediation footprint was bounded by "clean" samples, the decision unit is expected to be conservative. Post-excavation confirmatory sampling will be conducted from within each floodplain grid cell to verify that remediation objectives have been met; post-excavation confirmatory sampling will not occur in areas where the excavation terminates at the concrete liner or impenetrable material (e.g., bedrock) (see Section 2.1). Samples will be analyzed via Hybrizyme PCB immunoassay test kits (USEPA Method 4020) in accordance with the approved *Interim Measures QAPP* (ENVIRON 2006b) and addenda.

The IM SOW requires that criteria be established prior to initiation of each IM. These criteria will be used to judge the function of the IMs (excluding operations, monitoring, and maintenance). The performance criteria for IMs 2 and 4.C are described in Section 2.1.2.

3.1.7 Develop the Detailed Plan for Obtaining Data

A three-phased sampling investigation was instituted along under IM 1 to obtain the data necessary to complete the excavation required by IMs 2 and 4.C. For IM 2, the initial phase of the sampling design necessary for IM 2 (ENVIRON 2005a) included a stratified sampling approach throughout the floodplain of Reach 1 and Reach 2 of Dicks Creek. Sample locations were divided among two strata (i.e., Reach 1 and Reach 2) and nine sub-strata (i.e., Areas A through G in Reach 1 and the north and south sides of Reach 2). The spacing and density of sample locations were determined using professional judgment, approved by United States et al., and adjusted in the field in consultation with

USEPA field personnel. For IM 4.C, the initial phase of the sampling design (ENVIRON 2005a) included systematic grids centered on S25/S28.

Following analyses and visual observations of free product, it was determined that a broader sampling approach would be necessary during a second phase. The second phase investigation (ENVIRON 2006a) drew upon the results of the first phase to refine the hot spots through a combination of regularly spaced samples and systematic grid sampling. Three sampling strategies were applied to the hot spots based upon the spatial extent of contamination (i.e., contiguous hot spots in Reach 1 and isolated hot spots in Reach 1). Each strategy was determined using professional judgment and approved by United States et al. prior to sampling.

Following the results of the second phase, it was clear that the floodplain issue had expanded in scope from what was contemplated in the Consent Decree. Incorporating the results of earlier work (i.e., Phase I and II), the third phase investigation (ENVIRON 2007a) utilized a new rigorous strategy that was designed to fully delineate the hot spot locations in Reach 1 of Dicks Creek, reexamine areas previously determined not to be hot spot locations, and effectively determine vertices of the cut lines. The new strategy considered the general dimensions of the Miami Conservancy District’s channel constructed in the late 1960s and the presumed anisotropic nature of alluvial deposition in a channelized system. Based on these considerations, samples were collected along regularly-spaced transects at depths targeted from the alluvial material deposited over the circa 1967 channel.

Together, these data were used by a team of experienced ENVIRON technical personnel and specialty subcontractors to design the excavation effort. The design effort must be approved by United States et al. prior to initiation. Oversight of the excavation effort will be provided by the team of experienced ENVIRON technical personnel and specialty subcontractors.

3.2 Sediment Delineation, Remediation, and Restoration

Components of the remediation and restoration of sediment in Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch are tied into multiple IMs:

- IM 6 (delineation, excavation and proper disposal of sediment and other material from Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch); and
- IM 8 (restoration of Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch).

Below, related elements of these IMs are examined in conjunction through the DQO Process.

3.2.1 State the Problem

PCBs have been historically identified in the sediment of Dicks Creek and pose a potential threat to human health and the environment. Under the IM SOW, AK Steel has identified:

- The horizontal and vertical extent of sediment (sand or finer) present in Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch; and
- The vertical extent of PCB contamination in the underlying clay in Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch.

The IM SOW further requires AK Steel to remove all sediment, as well as any contaminated clay therein. Following excavation, AK Steel must restore these areas, minimize channel incision, and restore biological productivity to the extent practicable.

Using the DQO Process, a planning team was developed consisting of the AK Steel Project Manager, the AK Steel Project Coordinator, the ENVIRON Project Manager, and supporting ENVIRON technical staff (i.e., chemists, geologists, engineers, and quality assurance specialists). The duties of the team members have been discussed in the *Interim Measures QAPP* (ENVIRON 2006b). The decision maker for the DQO planning team is the AK Steel Project Manager, and all decisions must be formally approved by United States et al. All activities associated with IMs 6 and 8 must be consistent with the terms of the Consent Decree. In addition, IMs 6 and 8 require access agreements from impacted property owners and obtainment of all necessary permits.

3.2.2 Identify the Goals of the Study

The overall goals of IMs 6 and 8 are:

- The excavation and proper disposal of sediment and any underlying clay or other native material within Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch that exceeds the Action Level (i.e., the IM 6 cleanup goal);
- The restoration of Reach 1 of Dicks Creek to minimize channel incision and restore biological productivity to the extent practical;
- The restoration of the Outfall 002 Channel to pre-existing grade through the installation of riprap; and
- The restoration of Monroe Ditch to limit movement of contaminants from the adjacent areas, minimize channel incision, restore biological productivity to the extent practical, and limit further impairment of the stream.

In order to achieve these goals, the following study determinations were made during the investigation conducted under the *Sediment Delineation Sampling and Analysis Plan, Revision* (ENVIRON 2005b):

- The horizontal and vertical extent of depositional sediment (sand or finer) within the spatial boundaries of the study;

- The vertical extent of PCB concentrations in the confining clay layer or other native material underlying the depositional sediments, or in any exposed geological sand units within the spatial boundaries of the study;
- An understanding of the current spatial information, surface water flow, and stream gradient of Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch;
- An understanding of equipment access constraints through the documentation of the topography of the adjacent floodplain in Dicks Creek and Monroe Ditch; and
- The potential upwelling hydrodynamic pressure on Monroe Ditch for the consideration of a liner.

Information gathered from these determinations was used to design: (1) the excavation and disposal of all sediment and any underlying clay or other native material that exceeds the Action Level (see Section 3.2.5); and (2) the restoration activities. No action is required in areas determined to be below the Action Level. The design of these actions has incorporated design requirements related to the excavation, disposal, and restoration activities associated with IMs 2, 3, 4.B, and 4C.

3.2.3 Identify Information Inputs

Sediment probes, sediment borings, and analytical data for total PCB concentrations served as the primary inputs into the decision making process for IM 6. These decisions were controlled by the Action Level (see Section 3.2.5), which has been agreed upon in the IM SOW (Attachment 1 of the Consent Decree) by United States et al. and AK Steel.

The collection of data was implemented under the approved *Sediment Delineation Sampling and Analysis Plan* (ENVIRON 2005b) and in accordance with the *Interim Measures QAPP* (ENVIRON 2006b) and addenda. Sediment sample locations were determined in the field according to the approved sampling strategy, and as appropriate, in consultation with USEPA field personnel. Samples were collected by direct push methods (i.e., AMS SBS® Sediment Sampler, hand auger). PCB homologues were analyzed by TDI-BI according to USEPA Method 680 (TDI-BI 2005; USEPA 1985). The detection level associated with this method was well below the Action Level that was used. Results of analyses were reported in the approved *Data Summary Report: Sediment Delineation, (August 22, 2005 – March 30, 2006), Revision 1* (ENVIRON 2006d).

Physical and hydrological characteristics of Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch served as the primary input into the decision making process for IM 8. Current spatial information for Reach 1 of Dicks Creek, the Outfall 002 Channel and Monroe Ditch, along with sediment thickness, surface water flow, and stream gradient were all determined in accordance with the approved investigation strategy and have been reported in the approved *Data Summary Report: Sediment Delineation, (August 22, 2005 – March 30, 2006), Revision 1* (ENVIRON 2006d). Together, these data along with established stream restoration principles and best management practices will be used to direct decisions.

3.2.4 Define the Boundaries of the Study

The target population for IMs 6 and 8 consisted of continuous media (i.e., all depositional sediment [sand or finer] and underlying clay or other native material). These target populations were defined by both temporal and spatial boundaries. The temporal boundaries of the target population included all sediment, underlying clay, and underlying native material samples collected by ENVIRON during the years 2005 through 2006, as presented in *Data Summary Report: Sediment Delineation, (August 22, 2005 – March 30, 2006), Revision 1* (ENVIRON 2006d). The spatial boundaries of the target population were focused on three distinct subpopulations, each sharing relatively homogenous characteristics (see Figure 1-2):

<u>Reach 1 of Dicks Creek</u> included the channelized stretch of Dicks Creek extending from approximately 50 feet upstream of Outfall 002 to approximately 50 feet downstream of the former USGS gauging station downstream of Yankee Road.

<u>Outfall 002 Channel</u> included the short drainage channel incised into the Dicks Creek floodplain terrace that discharges Outfall 002 into Dicks Creek.

<u>Monroe Ditch</u> included the lower 0.6 miles of the stream tributary from the railroad culverts (at the southern boundary of the slag processing area) to the confluence with Dicks Creek (near the Norfolk Southern railroad bridge) that flows generally from south to north adjacent to AK Steel's closed landfills at the west end of the slag processing area. Restoration activities associated with IM 8 will extend into the riparian corridor of this area.

Spatially, the banks of these target populations defined the landward boundaries of these target populations for IM 6. The depth of the sediment and underlying clay or other native material relevant to this study extended to refusal depths or at least eight feet below the upper surface of the sediment. The study did not extend into any underlying bedrock or other rock strata. Generally, the restoration activities for IM 8 will extend beyond these boundaries into the excavated floodplain channel (IMs 2 and 4.C). In particular, these spatial boundaries for restoration will be limited within the concrete liner associated with the Norfolk Southern railroad bridge.

Sampling units from the target population corresponded to each single sediment sample, homogenized and sub-sampled from a discrete depth interval from each sample location. Together, adjacent sampling units were used to establish the bounds of decision units. Thus, each decision unit corresponded to the three-dimensional volume of material surrounding and represented by a single sampling unit[9]. The decision rules (see Section 3.2.5) were used to determine whether each decision unit is excavated and restored or left in place.

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[9] The bounds of the decision unit associated with sediment sample DC1-SC17A could not be established at the time of the sediment investigation. Initially, the bounds of this decision unit (and the associated excavation surface) will be based on neighboring floodplain samples that satisfy the IM 6 Action Level which are positioned at an elevation below the unbound decision unit. Following sediment removal to the excavation surface, confirmation samples will be collected and analyzed to confirm this vertical boundary.

3.2.5 Develop the Analytical Approach

The IM SOW specifies that all sediment will be removed. Thus, no decision rule is necessary for the sediment excavation required by IM 6. The IM SOW also specifies the cleanup standards for underlying clay or other native material and so these concentrations become the Action Level for IM 6. Thus, the decision rule for underlying clay or other native material is as follows:

> *If the spatially-averaged residual concentration of sampling units within a subpopulation (see Section 3.2.4) exceed 1.5 mg/kg total PCBs or a single sampling unit exceeds 3.0 mg/kg total PCBs, then the decision unit encompassing the sampling unit (i.e., all sediment within the three-dimensional remediation footprint) will be excavated and disposed.*

Generally, each sample location was represented by a single sampling unit. However, if multiple analyses occurred at one sampling location (e.g., duplicate samples, sample dilutions, reanalysis), then the maximum detected value was considered for the remediation design. AK Steel considered qualified estimated results in excess of the cleanup criteria in the remedial design.

Following remediation, the IM SOW specifies that Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch must be restored. Therefore, no analytical approach is necessary for the completion of IM 8. Thus, the decision rule is as follows:

> *If any portion of Reach 1 of Dicks Creek, the Outfall 002 Channel, or Monroe Ditch is remediated, then that specific portion will be restored.*

Specifically, sampling units from any portion of Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch that are remediated during IM will be restored following remediation activities.

3.2.6 Specify Performance of Acceptance Criteria

Since the sampling and analytical approach can only estimate the true condition of the underlying clay or other native material, an incorrect decision (i.e., decision error) could potentially be made if erroneous data are used. Sources of error associated with the data set used for decision making may have existed due to inherent variability in the sample collection and analytical processes.

The two main components of the total study error include sampling error (i.e., sampling design does not take into account the amount of variability within the media) and measurement error (i.e., inherent errors associated with sample collection, handling, preparation, analysis, and data reduction). Sampling error was reduced through use of a strategic phased sampling investigation. Measurement error was minimized through the strict adherence to approved field and laboratory SOPs and through the evaluation of data quality indicators described in the *Interim Measures QAPP* (ENVIRON 2006b) including precision, accuracy, representativeness, completeness, comparability, and conformance with reporting limits and/or estimated quantitation limits.

Two types of decision errors are common in environmental measurements. False rejection errors (i.e., Type I errors or false positives) can occur when the data suggests that the baseline condition does **not** exist when, in fact, it does exist (e.g., determining that a contaminated sample is not contaminated, thus requiring no remediation of the associated decision unit). False acceptance errors (i.e., Type II errors or false negatives) can occur when the data suggests that the baseline condition does exist when, in fact, it does **not** exist (e.g., determining that a non-contaminated sample is contaminated, thus requiring remediation of the associated decision unit). In order to be conservative, only false rejection errors were considered since the error could result in human health and/or ecological impacts.

For the purposes of IM 6, decision units surrounding contaminated sampling units were determined and are targeted for excavation. Decision units targeted for excavation correspond to the entire extent of sediment and to underlying clay or other native material within the three-dimensional remediation footprint surrounding any sampling unit that exceeded the Action Level. The vertices of the underlying clay or other native material remediation footprint were developed from the surrounding sampling units that fell below the Action Level. Thus, as the remediation footprint was bounded by "clean" samples, the decision unit is expected to be conservative.

The IM SOW requires that criteria be established prior to initiation of each IM. These criteria will be used to judge the functioning of the IM (excluding operations, monitoring, and maintenance). The performance criteria for IMs 6 and 8 are described in Section 2.2.2 and Section 2.4.2, respectively. Additional performance criteria may be specified in the permits.

3.2.7 Develop the Detailed Plan for Obtaining Data

A strategic sampling investigation was instituted under IM 6 to obtain the data necessary to complete the excavation and restoration efforts within Reach 1 of Dicks Creek, the Outfall 002 Channel, and Monroe Ditch required by IMs 6 and 8. The sampling activities were designed to obtain the information necessary to understand the pre-existing conditions including: (1) the horizontal and vertical delineation of sediments (sand or finer); (2) the PCB analysis of clay or other native materials from 2 to 8 feet below the upper sediment surface; (3) current spatial information; (4) surface water flow; and (5) stream gradient. The sampling location strategy was developed in the *Sediment Delineation Sampling and Analysis Plan* (ENVIRON 2005a) and approved by United States et al. In the field, sample locations were determined using professional judgment in accordance with the approved sampling strategy, and sample locations and sampling techniques were modified as necessary, in consultation with USEPA field personnel.

Together, these data, along with established stream restoration principles and best management practices, were used by a team of experienced ENVIRON technical personnel and specialty subcontractors to design the excavation and restoration effort. The design effort must be approved by United States et al. prior to initiation. Oversight of the excavation and restoration effort will be provided by the team of experienced ENVIRON technical personnel and specialty subcontractors.

3.3 MDA-33S Containment and Recovery

IM 3 remedial activities include the delineation, containment, and recovery of free product in the vicinity of the MDA-33S groundwater monitoring well. Below, elements of this IM are examined in coordination with excavation activities of IM 6.

3.3.1 State the Problem

Free product has been identified in monitoring well MDA-33S during the field activities associated with the Tube City IMS Area soil and groundwater investigation (ARCADIS 2002) and poses a potential threat to human health and the environment. Under the IM SOW, AK Steel first delineated the extent and nature of the free product in and around MDA-33S, and now must contain and recover the free product.

Using the DQO Process, a planning team was developed consisting of the AK Steel Project Manager, the AK Steel Project Coordinator, the ENVIRON Project Manager, and supporting ENVIRON technical staff (i.e., chemists, geologists, engineers, and quality assurance specialists). The duties of the team members have been discussed in the *Interim Measures QAPP* (ENVIRON 2006b). The decision maker for the DQO planning team is the AK Steel Project Manager, and all decisions must be formally approved by United States et al. All activities associated with IM 3 must be consistent with the terms of the Consent Decree.

3.3.2 Identify the Goals of the Study

The overall goal of IM 3 is the containment and recovery of free product, PCBs, and other contaminants of concern in groundwater in the vicinity of MDA-33S, so as to prevent its migration into Monroe Ditch. In order to achieve this goal, the following principle study determinations were made:

- The horizontal and vertical extent of PCB contaminated groundwater along the longitudinal axis of Monroe Ditch adjacent to or in the vicinity of MDA-33S;
- The horizontal and vertical extent of any free product along the longitudinal axis of Monroe Ditch adjacent to or in the vicinity of MDA-33S;
- The installation and operation of a free product and associated PCB contaminated groundwater recovery system to prevent the migration of free product associated with MDA-33S and associated PCB contaminated groundwater into Monroe Ditch;
- The thickness and physical properties of soils along the longitudinal axis of Monroe Ditch adjacent to or in the vicinity of MDA-33S through which a containment barrier will be installed; and
- The potential corrosive properties of groundwater along the longitudinal axis of Monroe Ditch adjacent to or in the vicinity of MDA-33S through which a containment barrier will be installed.

Information gathered from these determinations was used to design a hydraulic and physical containment barrier with flow-through treatment cells to contain and collect free product and treat PCB-impacted groundwater moving from the closed landfill toward Monroe Ditch. This design, using oil/water separators and absorptive media, will: (1) accumulate free product in a series of treatment cells that will be periodically recovered through pumping; and (2) treat groundwater for dissolved PCBs before infiltration on the downgradient side of the barrier. The construction of this system will include the excavation and disposal of any soil outside (i.e., east) of the containment barrier during the implementation of IM 6.

3.3.3 Identify Information Inputs

Environmental media in and near MDA-33S have been sampled by AK Steel. The relevant historical data set includes existing soil and groundwater analytical data and geospatial data from an investigation of the Tube City IMS Area (ARCADIS 2002). This reviewed historical data set served as a preliminary source of spatial boundaries and a source of supporting geophysical data.

The location, mobility, and chemical and physical properties of the free product in the vicinity of MDA-33S was determined through the investigation of the *Upland Sources Sampling and Analysis Plan, Revision 4* (ENVIRON 2007b). The data reported in *Data Summary Report: MDA-33S* (ENVIRON 2008c) and periodic monitoring data reports served as the primary inputs into the engineering design used to contain and recover the free product. The nature of the free product was determined through the analysis of PCB-homologues by TDI-BI and analyses of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals by TestAmerica Analytical Testing Corporation.

In addition, geotechnical data from this sampling effort were used to support the remediation Design Document for MDA-33S required by the IM SOW. Using these data, the design and specifications of the containment barrier to be installed in the vicinity of MDA-33S was determined. Soil was collected at discrete depth intervals for geotechnical characterization. The laboratory analyses include soil description and classification, Atterberg limits, grain size distribution, and triaxial compression tests for consolidated and unconsolidated soils.

Due to concerns of United States et al., AK Steel proposed to supplement the *Upland Sources Sampling and Analysis Plan, Revision 4* investigation under a letter amendment (AK Steel 2007). United States et al. approved this supplemental work with conditions (USEPA 2008b). Details of this investigation were reported in the letter report *Addendum to Upland Sources Sampling and Analysis Plan, Revision 4: Installation of Additional Monitoring Wells Adjacent to Monroe Ditch* (ENVIRON 2008d). The data confirmed the delineation reported in *Data Summary Report: MDA-33S* (ENVIRON 2008c) and served as supplemental inputs to refine the engineering design used to contain and recover the free product and other contaminants of concern.

3.3.4 Define the Boundaries of the Study

The target population for IM 3 was defined by both temporal and spatial boundaries. The temporal boundaries of the target population included all soil and groundwater samples collected since the initial investigation in 1998 by AK Steel through the current monitoring activities associated with the *Upland Sources Sampling and Analysis Plan, Revision 4* (ENVIRON 2007b) and addenda. The spatial boundaries of the target population were less clearly defined and have expanded since the beginning of the investigation. Initially, the study area was bounded to the north by monitoring well location MDA-34P, at which free product was never encountered, and was unbounded to the south. MDA-33S is flanked to the west by a closed landfill (SWMU 39) and to the east by Monroe Ditch, and therefore, free product delineation activities were restricted to a series of borings running parallel to Monroe Ditch, north and south of MDA-33S[10]. Following the proposal for supplemental investigation (AK Steel 2007), the study area and the associated delineation activities were extended to include the area from the northern and north-eastern perimeter of SWMU 39 to Monroe Ditch. The depth of soil relevant to these studies extended to the underlying clay unit encountered between 626 and 633 feet above mean sea level.

Multiple sampling units have been collected throughout these investigations. Investigative sampling units correspond to each investigative boring collected throughout the spatial boundaries of IM 3 and intended for the field screening of free product. Geotechnical sampling units correspond to each 2.8 inch diameter, 30 inch Shelby tube soil samples collected beyond the investigative borings containing free product. Together, these various sampling units were used to determine the extent of the decision unit. Thus, the decision unit corresponded to the lateral extent of PCB contaminated groundwater and free product between the closed landfill and Monroe Ditch along which a containment barrier was designed and will be constructed. This decision unit has been confirmed through periodic monitoring sampling units which corresponded to the monthly water depth and free product presence (or absence) determinations, and the presence (or absence) of PCB contaminated groundwater.

3.3.5 Develop the Analytical Approach

At MDA-33S, soil screening methods were employed in a stepwise fashion. Visual staining and photo-ionization detector evaluation were used for soil samples to corroborate the presence of free product. These field screening methods were used to determine the following decision rule:

> *If the field screening methods indicate the presence of free product, then that sampling location will be considered to be contaminated.*

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[10] The area west of the MDA-33S investigation (SWMU 39) was subject of a separate investigation reported as *Laboratory Analytical Results for Intrusive Investigation of SWMUs 38 and 39* (ARCADIS 2008). Any soil located within the north-south delineation of MDA-33S and between the containment barrier and Monroe Ditch will be removed during the implementation of Interim Measure 6.

The sampling locations nearest MDA-33S that did not contain detectable free product determined the extent of the decision unit at which engineering controls will be built to contain and recover the free product. To confirm the decision unit, temporary monitoring wells were installed and monitored for free product during the design phase with an interface probe and photo-ionization detector. The temporary monitoring wells have provided an *in situ* measure of free product mobility[11].

3.3.6 Specify Performance of Acceptance Criteria

Since the investigative approach can only estimate the true condition of the upland soil area, an incorrect decision (i.e., decision error) could potentially be made if erroneous data are used. Sources of error associated with the data set used for decision making may exist due to inherent variability in the sample collection and analytical processes.

The two main components of the total study error include sampling error (i.e., sampling design does not take into account the amount of variability within the media) and measurement error (i.e., inherent errors associated with sample collection, handling, preparation, analysis, and data reduction). Sampling error was reduced through use of a strategic sampling investigation based on historical data and professional judgment. Measurement error was minimized through the strict adherence to approved field and laboratory SOPs and through the evaluation of data quality indicators described in the *Interim Measures QAPP* (ENVIRON 2006b) including precision, accuracy, representativeness, completeness, comparability, and conformance with reporting limits and/or estimated quantitation limits.

Two types of decision errors are common in environmental measurements. False rejection errors (i.e., Type I errors or false positives) can occur when the data suggest that the baseline condition does **not** exist when, in fact, it does exist (e.g., determining that a contaminated sample is not contaminated, thus creating a barrier which does not entirely contain the free product present and potentially allows it to migrate into Monroe Ditch). False acceptance errors (i.e., Type II errors or false negatives) can occur when the data suggests that the baseline condition does exist when, in fact, it does **not** exist (e.g., determining that a non-contaminated sample is contaminated, thus creating a barrier which unnecessarily extends beyond the extent of free product). In order to be conservative, only false rejection errors were considered since the error could result in human health and/or ecological impacts.

For the purposes of IM 3, the data confirming: (1) the presence or absence of free product within soil borings; (2) the mobility of free product into the temporary monitoring wells; and (3) the presence or absence of PCB contaminated groundwater was used to establish the design and placement of the barrier. Through repeated data

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[11] Free product at MDA-33S was assumed to be mobile based on observations reported by ARCADIS (2002). The mobility of free product was confirmed when it accumulated in some temporary monitoring wells. Free product accumulated only in those wells positioned within the extent of free product (as determined during the field screening of investigative borings).

collection, the monitoring period associated with the temporary monitoring wells (i.e., August 2007 to present) helped to eliminate false negative errors. In addition, the placement of sentinel wells (beyond the extent of the containment barrier) will serve as confirmation of the design decisions. The subsequent monitoring of these sentinel wells, as described in the corresponding operations and maintenance plan (see Attachment 4), will allow for continued confidence in the decision.

The performance criteria that will be used to judge the functioning of IM 3 are described in Section 2.3.2.

3.3.7 Develop the Detailed Plan for Obtaining Data

A strategic investigation was conducted under the *Upland Sources Sampling and Analysis Plan, Revision 4* (ENVIRON 2007b) in order to obtain the data necessary to complete the engineering controls required by IM 3. Soil screening methods were utilized to evaluate the presence of free product among eleven investigative soil borings and to delineate its extent in the vicinity of MDA-33S. Seven temporary monitoring wells were installed in this area (i.e., one replacement well, three north of MDA-33S, and three south of MDA-33S) to evaluate free product mobility. In each direction, two monitoring wells were installed within the "uncontaminated" extent of the decision unit, and one monitoring well was installed within the "contaminated" side of the decision unit. Approximately eight months later, five additional temporary monitoring wells were installed along the northern and north-eastern perimeter of SWMU 39 (ENVIRON 2008d) to determine if groundwater in this area was contaminated with PCBs and if additional free product pathways existed. Boring and well locations were determined using professional judgment in accordance with the approved sampling strategy.

The data obtained from these investigations were used by a team of experienced ENVIRON technical personnel and specialty subcontractors to design the containment, collection, and treatment effort. The design must be approved by United States et al. prior to initiation. Oversight of the installation will be provided by the team of experienced ENVIRON technical personnel and specialty contractors.

3.4 Evaluation of DQO Process

In environmental data collection projects, the ultimate goal of the DQO Process is the obtainment of high quality and valid data to support environmental decisions. This goal can be achieved through systematic planning and strict adherence to quality assurance/ quality control (QA\QC) measures.

The DQO Process was initiated to guide the IM investigations. The data generated through these investigations were collected based on approved sampling strategies, analyzed using approved standard analytical methods, and validated in accordance with standard guidelines (USEPA 1999) while adhering to QA/QC measures of the approved *Interim Measures QAPP* (ENVIRON 2006b). These investigations have produced high quality and valid data that were utilized throughout the decision process for the design of remediation and restoration activities presented in this report.

4.0 REACH 1 FLOODPLAIN SOIL AND SEDIMENT EXCAVATION

The excavation of the floodplain soils (IM 2 and IM 4.C) and the removal of sediment from Dicks Creek and Outfall 002 Channel (IM 6) will be completed as one design.

4.1 Design Basis

Dicks Creek Reach 1 is a small, partially channelized urban stream that consists of an incised low flow channel through a floodplain bounded by levees. The floodplain soils consist generally of infill farm soils with some sand lenses. The Floodplain Test Pit Program (Attachment 5) found that the stratigraphy of the floodplain generally consisted of three units (Surface Unit, Intermediate Unit, and Lower Unit), as described in Attachment 3. Water content is a function of precipitation and stream flow events. Sediment within the incised low flow channel is generally fully saturated, coarse-grained material (that is less than gravel size) that is located on top of native clay or till.

The remediation of Dicks Creek Reach 1 includes removal of sediment and floodplain soil to a specified elevation-based design surface (based upon analysis and sampling by ENVIRON), followed by confirmatory sampling of the floodplain soils areas.

4.1.1 Design Constraints

There are several significant design constraints that required consideration and evaluation in developing an effective remedial method for the Dicks Creek floodplain and sediment remediation and subsequent restoration (which is discussed in Section 7).

The excavated soil/sediment is to be delivered to either a municipal landfill or a TSCA landfill, depending upon the PCB concentration. Landfill regulations prohibit free water in the material as defined by the paint filter test. Consequently a primary design constraint is producing soil/sediment in a cost effective manner that can meet the free water restrictions. The two basic design options to achieve this endpoint are to excavate wet material and subsequently dewater and stabilize it for delivery to a landfill, or to first remove the water from the work area and then complete the excavation in a relatively dry state that produces material suitable for landfill with limited, if any, stabilization required. The second method (working in the dry) not only reduces the need for post-excavation dewatering and stabilization of material prior to landfill delivery, but also improves on-site operations by allowing the equipment operator to see what they are excavating, making the material handle better on-site, reducing the amount of sediment entrained water that needs to be managed on-site, and reducing the area needed for *ex situ* dewatering and stabilization.

This design is based on removing water from the work area before excavation. A primary site constraint impacting the design methodology is the limited site access and the limited available area for staging, stockpiling, and dewatering excavated material. The limited space is insufficient to stockpile and/or dewater large volumes of excavated materials. Consequently the design is focused on removing water prior to excavation and keeping other water out of the excavated material rather than trying to remove entrained water after excavation. This will be achieved by bypassing as much of the Dicks Creek flow as is considered reasonably possible and capturing and removing groundwater and other water that accumulate in the excavation area to the degree possible. Groundwater management by well points or drains may be implemented if necessary to remove groundwater prior to excavation.

Flows on Dicks Creek are highly variable in response to storm events and are a significant factor in designing a relatively dry remedial excavation project. Dicks Creek base flows are generally low and manageable with bypass pumping systems. However the creek is subject to flash floods. The base flow is primarily provided by the discharge from Outfalls 1 through 6 and averages 10 to 20 cubic feet per second (cfs) (4,500 to 9,000 gallons per minute [gpm]) during the summer exclusive of storm events. The annual average flow is 50 cfs (22,000 gpm) and the 2-year storm event is over 2,000 cfs (0.9 million gpm), which is over 200 times the summer base flow. The flows increase to over 3,000 cfs (1.35 million gpm) for the 5-year storm event. Analysis of historical precipitation data and stream flow modeling identified June 1 to November 30 as the preferred construction season with the lowest monthly average stream flow. This creates design constraints related to potential flow and flooding in Dicks Creek, as well as temporal constraints that reduce the annual construction season. Attempting to perform this type of remediation during the typically wetter season would significantly compromise project effectiveness and the ability to achieve remedial objectives.

Even during the identified construction season of June 1 to November 30, the storm event flows can be too large to efficiently pump around the remediation work area. Rerouting the Dicks Creek channel outside the floodplain is not a practical option because the area is developed and there is no viable corridor outside of the creek in which to route the large flood events. Therefore, remediation is based on: (1) bypassing a given flow rate of Dicks Creek flow around the work area allowing remediation and restoration to occur; and (2) stabilizing and evacuating the work area during major storm events to allow the flood water to flow through the existing channel, as it currently does.

An additional design constraint is maintaining the flood routing capacity of Reach 1 during construction. The activities in Reach 1 cannot block the flow through Reach 1 in a manner that would cause increased flooding upstream. This limits the height of any fixed flow control structure to the existing grades within the floodplain and creek, and greatly limits the types of flow control structures that may be used for bypassing high storm flows. Consequently the bypass system is being designed with flow control structures of a height that will allow major storm flows to pass without restrictions and that will not increase out of bank flooding based on historical storm and creek stage data.

Access to the remediation area of Dicks Creek is very limited. Dicks Creek is generally bordered by adjacent properties that constrain access. There are also limited available staging and stockpiling areas that are not located within the floodplain, which provide access to the site and local roads for off-site transport. Addressing these constraints will require proper balance of on-site production and off-site transport in order to efficiently perform the project. Based on discussions with the selected disposal facilities, existing daily landfill capacity is not likely to be a limiting factor in potential daily production.

4.1.2 Design Strategy

Mechanical excavation using conventional track-mounted excavators and haul trucks was selected over hydraulic dredging alternatives because of the site characteristics and the large volumes of water that is entrained in excavated sediment using hydraulic dredges. Mechanical excavation does not require the addition of any water and removes material at its *in situ* moisture content.

Hydraulic dredging will typically produce slurry that averages 6 percent (%) to 10% solids, with a volume of entrained water that is 5 to 10 times the volume of sediment dredged. All of the excess water has to be removed from the slurry and treated, and the sediment has to be dried to the extent that it passes the paint filter test requirement for the landfill. Depending upon material characteristics water management can be either passive draining of excess water from contained stockpiled sediment or active dewatering with mechanical dewatering such as belt or filter presses, centrifuges or using Geotubes™, flocculants or additives. All of these water management alternatives have a significant project footprint, as well as power and fresh water usage. Sufficient space to handle this type of project excavation volume is not reasonably available.

The majority of the material to be removed is soil within the floodplain that is above the baseline flow level of the creek and above the elevation of the groundwater and, therefore, should pass the paint filter test (DOF 2008 Data Report, Flood Plain Test Pit Program [see Attachment 5]) barring inundation or significant precipitation. Consequently the preferred remediation method is dry, mechanical excavation using land-based excavators and haul trucks, facilitated with bypass pumping of the base flows of Dicks Creek and Monroe Ditch. The staging areas should provide sufficient capacity for stockpiling material that is excavated in the dry, which will allow material to stack. Therefore, landfill daily acceptance rates are not likely to impact the production schedule.

Two alternatives for dry excavation were examined: phased remediation and bypass pumping.

4.1.2.1 Phased Remediation Alternative

The phased (cell) approach includes constructing incremental enclosed cells (e.g., via sheetpile) that each exclude the Dicks Creek flow from a portion of the remediation area, excavating the designated soils in the dry, removing the enclosure, and repeating the process in the next adjacent cell area. The cells would be set up as multiple pairs along the creek with the center of each pair at the low flow channel edge. The creek flow would then remain either in the existing low flow channel or be diverted through the excavated area.

This approach requires construction of a bridge across the creek for access to both sides of the floodplain, sequential installation and removal of the sheetpile enclosures, and groundwater management. Construction time of the sheetpile enclosures is approximately five months in addition to the time required to excavate the floodplain soil. This would require either working in the winter months or a multi-year summer only project.

Sheetpile height for the enclosure would be limited to existing floodplain elevation. Storm events that exceed low flow channel banks would flood through the work area. Additional geotechnical data would be needed for sheetpile design. The potential for contaminant carry down into aquifers below the aquitard during the installation of sheetpiling is also a concern.

4.1.2.2 Bypass Pumping Alternative

The bypass pumping approach is based on installing temporary dams across the low flow channel and using multiple pumps to reroute the base flow of Dicks Creek around the work area returning it to the channel downstream of the work area. The bypass pumping alternative provides more flexibility than the phased remediation alternative as the number of pumps can easily be varied or adjusted to accommodate the low flow of around 20 cfs (9,000 gpm) to an intermediate and practical bypass flow. The phased remediation approach has a fixed installation/removal cost for the sheetpile. Work area protection is set by the sheetpile top elevation. The bypass pumping alternative allows a system to be designed for a flow less than the maximum low flow channel flow that can then be adjusted in the event of a wetter than normal summer. The water management system would also be designed to capture limited stormwater and groundwater entering the excavation area.

The bypass pumping alternative does not require a temporary bridge across Dicks Creek, as the flow is being diverted and the entire creek bed and floodplain (levee to levee) is dewatered. This significantly improves access to the work area for remediation and restoration activities. Groundwater management would still be required, and some excavated material may need dewatering/treatment to meet the paint filter test.

4.1.3 Preferred Design Approach Summary

The preferred design approach is based on bypass pumping of the base flow up to a design flow level of Dicks Creek. This allows remediation and excavation work to proceed in the dry. It also allows evacuation of the work area during significant storm flows that exceed the design flow event. The construction season will be limited to between June 1 and November 30 each year, the period of the lowest average monthly flow in the creek based on modeling and analysis (see Attachment 6).

The design bases are discussed in detail in the following subsections for the following key remedial elements for excavation of soil and sediment in Dicks Creek Reach 1:

- Mechanical excavation of soils and sediment will be completed in the dry;
- Bypass pumping will be used to reroute Dicks Creek flow around the work area;
- Groundwater will be controlled with surface drainage and pumps;
- Remedial area will be divided into 10-foot by 20-foot grid cells;
- TSCA materials (>50 mg/kg PCBs) will be excavated prior to other materials (>5 mg/kg PCBs and <50 mg/kg PCBs) in all cells;

- Confirmatory soil samples will be collected from the post-excavation surface of each floodplain grid cell; and
- Excavated materials will be loaded into appropriately prepared trucks and hauled to landfill based on PCB concentration.

4.2 Excavation Design

The Reach 1 sediment and floodplain soil remediation will be implemented in five phases (Attachment 2). The concept is to methodically compress the "excavation-to-restoration cycles" from upstream to down, such that the remediation work zones can stand protected as much as possible during stormwater intrusions, and the downstream migration of impacted media can be managed. Within each phase area, the primary excavation will consist of bulk excavation to grid profile elevations approximately six inches above the design prism. Primary excavation will then be followed with a refined excavation to the specified compliance points, cell by cell. Additional excavation will be conducted if required based on confirmatory sampling results (Section 4.2.7).

TSCA excavated material will be loaded into trucks and transported to Staging Area 2. At the staging area, TSCA-material will be stockpiled consistent with applicable TSCA regulations (see Section 4.4.1.2) and/or transported directly to the landfill (see Section 4.3.3).

Non-TSCA excavated material will be loaded into off-road haul trucks for on-site transport to the material stockpiling, processing, and rehandling area where the material will be stockpiled, processed as necessary to meet the paint filter test, and rehandled into on-road trucks for transport to the landfill.

TSCA and non-TSCA materials will be maintained in separate stockpiles.

4.2.1 Excavation Footprint

Excavation footprints for TSCA and non-TSCA material were determined by the methods described in the following subsections.

4.2.1.1 TSCA Material Excavation

ENVIRON predicted the horizontal and vertical extent of TSCA material (TSCA Cleanup Surface) associated with all samples that had been determined to exceed 50 mg/kg PCBs dry weight (*in situ*) using EVS-PRO (C-Tech Developmental Corporation) kriging software (Sullivan et al. 2000). The TSCA Cleanup Surface associated with each TSCA sample represents the theoretical interface of TSCA and non-TSCA material based upon the analysis of input data (x, y-coordinates, elevation, and PCB concentration), construction of a variogram to best fit the data, and kriging based upon the variogram. This surface was then adapted for the capabilities of mechanical equipment excavation to produce the design prism (TSCA Excavation Surface) allowing stable side slopes (1:1) to the existing grade (daylighting boundaries). Thirty TSCA Areas were defined using this process; 28 Areas will be addressed during the 2009 effort[12].

A professional land surveyor licensed in the state of Ohio will establish pre-excavation permanent elevation benchmarks and survey control points. Compliance surveys of the excavation depths and dimensions will be performed in compliance with the technical specifications (Attachment 1). In order to maximize production and efficiency, the following will be used:

- Digital terrain modeling (DTM), by means of triangulated irregular networks (TINs), to electronically transfer the Remediation Surface and Excavation Surface elevations to an automated guidance system, and thus define the targeted excavation sub-surface dimensions for TSCA Areas;
- Real Time Kinematic Global Positioning System (RTK-GPS) excavation guidance equipment to position equipment and for use with roving survey equipment; and
- Excavators equipped with Trimble GCS900 grade control sensors and receivers to guide some of the machinery operators in the excavation process.

Post-restoration surveys and as-built final reports will be completed and certified by a professional land surveyor licensed in the state of Ohio.

The excavation of TSCA Areas will be advanced to elevations established by the site characterization and set forth in the remedial design drawings (Attachment 2). TSCA excavation will be extended to include any oily material encountered beyond the TSCA Cleanup Surface, as verified by photo-ionization detector (PID) readings exceeding 300 parts per million (ENVIRON 2007b). The calculated volume of the 28 TSCA Areas containing material ≥50 mg/kg PCBs to be removed is 1,850 CY, which does not include slopes for daylighting the excavation to existing grade. The calculated excavation volume including side slopes in the same area is 3,330 CY, an 80% increase above the volume for the TSCA Cleanup Surface or an over-excavated volume of non-TSCA material of 1,480 CY. Any significant overburden (i.e., greater than three feet above top of TSCA material) will be excavated in accordance with Attachment 1, set aside, and managed with the non-TSCA material once the TSCA material excavation is complete.

4.2.1.2 Non-TSCA Material Excavation

Based upon the chemical analysis of the site samples (see Section 3), ENVIRON developed the remediation surface ("Cleanup Surface") connecting the first clean sample beyond the last contaminated sample both horizontally and vertically. This clean soil/sediment surface is the result of extensive sampling and analysis approved by United

[12] TSCA Areas 17 and 18 are associated with TSCA material found outside the floodplain boundaries; the TSCA material in these Areas is limited to 8-10 feet below ground surface. These Areas will be addressed as Additional Areas under the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI).

States et al. and detailed in Sections 3.1.3, 3.1.4, 3.2.3, and 3.2.4. For floodplain soil, clean vertices (<5 mg/kg PCBs) beyond impacted (≥5 mg/kg PCBs) points were manually selected according to the criteria described in Section 3. The excavation depth was then determined based on the depth from the ground surface to the top depth of the clean vertex. Using three dimensional (3D) Analyst (ESRI), the depths were triangulated as mass points to create a three-dimensional TIN. The same procedure was used to create a sediment TIN using the sediment probe data[13]. The soil TIN and sediment TIN were then converted to rasters in 3D Analyst. The two rasters were merged together using the raster calculator feature in Spatial Analyst (using a union of inputs) to create the final Cleanup Surface. The final raster cell size is 2 feet x 2 feet.

The Cleanup Surface was then used to develop an excavation design ("Excavation Surface"), that develops a methodology to remove the designated material considering equipment limitations, equipment operational characteristics, site characteristics (e.g., access constraints, available staging areas, topography, groundwater, geographic location, neighboring properties) and material characteristics (e.g., grain size, water content, plasticity, contamination levels).

Attachment 2 shows the relationship between the excavation design and the ENVIRON Cleanup Surface. The excavation design was based upon the following criteria:

- The surface of grid cells inclines on only one plane, generally toward the low flow creek channel;
- The predominant slope is toward the center (low flow creek channel) with only minor sloping longitudinally; and
- Based upon slopes a rectangular grid cell was selected as more efficient than a square grid cell.

Various grid cell sizes were analyzed for volume of excavation in increments from 10 feet by 10 feet to 20 feet by 40 feet. A 10-foot by 20-foot grid cell (with the long side of each cell generally paralleling Dicks Creek) was selected as the most efficient excavation grid. The purpose of the grid is to provide a mechanism for setting excavation control points in the field, and for providing an excavation plan that can be implemented efficiently with available excavation equipment. The grid consists of flat and sloping cells, as follows:

- Flat Cells. For many grid cells the excavation is set to a constant elevation within the grid, which is equal to the lowest elevation of the Cleanup Surface within the grid. The constant excavation elevation for the grid cell will result in removal of a small volume of non impacted suitable material from beneath the Cleanup Surface.

[13] The sediment probe data only represents material that is sand or finer. Since some clean sediment samples were beneath the probed extent of sand or finer material, the sediment probe data TIN was modified to account for these samples.

- Sloping Cells. For some grid cells the excavation was set as a sloping surface, with the uphill length of the cell (away from Dicks Creek) set a constant elevation, and the downhill length of the cell (closest to Dicks Creek) set at a constant elevation lower than the uphill side resulting in a cell that slopes up and away from Dicks Creek. The sloping surface of the excavation grid was set at or below the Cleanup Surface, which results in removal of a small volume of suitable material from beneath the Cleanup Surface.

Within the Excavation Surface, a TSCA remediation surface design ("TSCA Cleanup Surface") was developed for the removal of floodplain soil and sediment material exceeding TSCA regulations, per 40 CFR 761.61(c)[14]. Based upon the chemical analysis of the site samples (see Section 3), ENVIRON predicted the horizontal and vertical extent of all samples that had been determined to exceed 50 mg/kg PCBs dry weight (*in situ*) using EVS-PRO (C-Tech Developmental Corporation) kriging software to generate a 3D shapefile. This shapefile was later exported to Computer Aided Design (CAD) to generate the TSCA excavation design ("TSCA Excavation Surface") whereby cut lines were developed around the extent of TSCA material allowing stable side slopes (1:1) to the existing grade (daylighting boundaries). Design drawings in Attachment 2 depict the TSCA material inside the TSCA Excavation Surface with overlying non-TSCA material; any significant overburden material (i.e., greater than three feet above top of TSCA material) will be excavated in accordance with Attachment 1, set aside, and managed with the non-TSCA material once the TSCA material excavation is complete.

A professional land surveyor licensed in the state of Ohio will establish pre-excavation permanent elevation benchmarks and survey control points. Compliance surveys of the excavation depths and dimensions will be performed in compliance with the technical specifications (Attachment 1). In order to maximize production and efficiency, the following will be used:

- DTM by means of TINs to electronically transfer the grid cells and remedial surface elevations to an automated guidance system, and thus define the targeted excavation sub-surface dimensions for each 10-foot by 20-foot grid;
- RTK-GPS excavation guidance equipment to position equipment and for use with roving survey equipment; and
- Excavators equipped with Trimble GCS900 grade control sensors and receivers to guide some of the machinery operators in the excavation process.

Post-restoration surveys and as-built final reports will be completed and certified by a professional land surveyor licensed in the state of Ohio.

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[14] An application for the risk-based disposal of Dicks Creek and Monroe Ditch PCB remediation waste was submitted by letter to the USEPA Acting Regional Administrator for Region 5 on February 12, 2009. Attached to the application, a certification signed by the Owner identifies where all sampling plans including sampling and analysis procedures, related this remediation effort are on file.

The excavation within Dicks Creek will be advanced to elevations established by the site characterization and set forth in the design drawings (Attachment 2). The calculated volume of the Cleanup Surface containing the material >5 mg/kg PCBs to be removed from Dicks Creek and Floodplain in Reach 1 is 51,000 CY, which does not include slopes for daylighting the excavation to existing grade. The calculated excavation volume including side slopes in the same area is 61,000 CY, a 20% increase above the volume for the Cleanup Surface or an over-excavated volume of clean material of 10,000 CY. This includes material within Monroe Ditch above the concrete liner to the upstream limit of the concrete liner in Monroe Ditch. This volume does not include any excavation of additional material following confirmatory sampling.

4.2.2 Design Flow

Flash flooding is a problem in Dicks Creek. The construction activities must not exacerbate flooding conditions upstream of the project area. The bypass pumps can divert the Dicks Creek average annual flow of 50 cfs (22,400 gpm) and the expected summer base flow of 10 to 20 cfs; however, providing pump capacity for large storm events is not practical or necessary. The bypass flow capacity was selected by considering the exceedance probability and project impacts. This system will have a minimum capacity of 100 cfs (45,000 gpm)[15] and is described in detail in Section 4.2.5. Table 4-1 shows the probability of exceedance for bypass systems sized to specified flows.

4.2.3 Groundwater and Precipitation

Groundwater flow into the work area will be controlled as needed using standard practices, such as trenches, dikes, and/or pumps. Since restoration work will follow immediately upon successful confirmatory sampling of remediation excavation, the area (and time) of open excavation will be limited, which should reduce the volume of groundwater flow to be diverted. In addition, the construction period of June through November is during generally falling groundwater elevations, again reducing the potential groundwater flow impacts. Any groundwater collected within the excavation area that may have come into contact with impacted soil/sediment will be classified as construction contact water and will be treated and discharged as described in Section 4.2.6.

Analysis of historical precipitation data and stream flow modeling by ENVIRON correlated stream flow and precipitation probabilities (Attachment 6). Stormwater that may have come into contact with the impacted soil/sediment in the dewatered work area or staging area will be treated as construction contact water and pumped to a water management area for treatment and disposal as described in Section 4.2.6.

[15] Bypass pump capacity design flow is based on twice the average annual flow.

4.2.4 Weather Escalation Plan

Due to the potential for significant flow events during severe weather, a detailed plan of weather monitoring, action levels, and associated protocols is provided as Attachment 7. The plan describes a real time weather prediction protocol for the site 24 hours per day, 7 days per week. The contractor will also have ability to stabilize the site and manage dams 24 hours per day, 7 days per week including during hours that remediation work is not actively being performed (including holidays).

Weather conditions will determine the action level, which dictates if additional evacuation steps are necessary. If a storm event is predicted to occur that will exceed bypass pump capacity, then the construction area will be stabilized and the flow will be allowed to pass through the project site.

4.2.5 Equipment

The materials and equipment necessary for this design are provided in Table 4-2. Additional details for dams, bypass pumps, piping, and trucks are provided in the following subsections.

4.2.5.1 Dams

An earthen dam and Super Sack dam bags will be used to prevent surface water flow into the remediation area. The earthen dam will be located upstream in Dicks Creek (i.e., Station 169+00). Details and specifications for the construction of the earthen dam are provided in Attachment 2.

Super Sack dam bags will be placed at the downstream extent of the work area (i.e., Station 141+00) to isolate the project area from backflow from Dicks Creek. Super Sack coffer dams have been successfully used in similar applications. Super Sacks are constructed of woven polypropylene and can be filled with sand and wrapped with low density polyethylene (LDPE) or similar to create a stable coffer dam. This system allows the coffer dam to be customizable to any configuration and height, accommodating variable river depths and irregular river beds. Construction details for the installation of the dam bags are provided in Attachment 2. They can be rapidly removed (2 to 4 hours) from the floodplain in anticipation of flooding.

4.2.5.2 Bypass Pumps and Piping

An intake sump pit and six suction lines will be installed upstream of the earthen dam at Station 169+00. Details of the sump construction for Dicks Creek are provided in Attachment 2.

In order to provide capacity for both the base flow 20 cfs (9,000 gpm) and a design flow of 100 cfs (45,000 gpm) at least five 18-inch pumps will be set up in parallel (Attachment 2). Each pump has an optimal capacity of 36 cfs (16,000 gpm) and a site-specific rating of 20 cfs (9,000 gpm) (Table 4-3). Additionally, one emergency back-up pump will be supplied for use as: (1) a replacement to be utilized in the event of a pump failure during a peak flow event or; (2) to supplement the bypass system to better manage those storm events at or slightly above the anticipated overflow criteria established. A fully automated and calibrated system of floats and triggering devices will be employed to regulate the number of pumps needed to be running at any one time to meet the stream discharge volume.

Throughout the duration of the project, the pumping systems are designed to be operational 24 hours a day. The contractor will have personnel to monitor, perform routine maintenance, and troubleshoot the pumping system 24 hours/day and 7 days/week. In addition to the automated regulation and triggering mechanisms, a separate alert and alarm system will be deployed to notify the operators if a pump were to become dysfunctional. The alert and alarm system will monitor the pumps and water levels within the sump 24 hours/day and 7 days/week. The remote terminal unit has a wireless web-based communication module that will alert project personnel via cell phone, email, text messenger, or pager.

The pumps will be located on the north side of Dicks Creek, upstream of the work area (Figure 4-1). The six bypassed water pipelines will be combined as illustrated in Attachment 2 into three pipelines. The discharge piping will cross Dicks Creek upstream of the upstream dam and then will be laid along the levee on the south side of Dicks Creek (Figure 4-1). A ramped fill will be required over the pipeline at Staging Area 2 and other locations to allow access to Staging Area 2 by off-road trucks for material rehandling and processing and to allow other vehicle crossing points. A temporary pipe crossing across the Monroe Ditch confluence will be constructed as necessary. The piping will come down off of the floodplain and into the stream bed to pass under the railroad bridge east of Yankee Road.

4.2.5.3 Excavation Equipment

The Reach 1 remediation excavation will be implemented using multiple excavators and bulldozers. At least one of the excavators will be equipped with a RTK-GPS guidance system. The Trimble GCS900 Grade Control System with dual Global Positioning System (GPS) and solid state angle sensors provides precise three dimensional positioning of the tip of the bucket. The dual antenna configuration combined with angle sensor on the boom and stick computes the exact position and orientation of the bucket. The on-board CB430 computer determines the position of each tip of the bucket and compares these positions to the design to display real-time cut/fill values. This combined with the in-cab mounted lightbars (part of the RTK-GPS system) show the operator what bucket movement is required to get to grade. Additionally, at least one long reach excavator (60-foot reach with boom and stick) will be available for additional excavation.

4.2.5.4 Trucks/Haulers

Off-road 25 ton or 40 ton articulating dump trucks will be used to transport materials on-site. All haul trucks will be labeled with placards to identify whether they are designated to haul TSCA or non-TSCA materials. Vehicles should not switch between TSCA and non-TSCA transport without decontamination being completed.

Before leaving the site, all off-site haul trucks will be equipped with tarps to reduce spillage and fugitive emissions. On-site haul trucks will be covered with tarps, as needed to control fugitive emissions based on weather conditions (e.g., windy days, water content of material).

4.2.6 Water Management

Water management strategies were designed based on the source and type of water, the potential chemical concentrations, and treatment and discharge options.

4.2.6.1 Water Management Classes

There will be several classes of water to be managed during the course of the project. Water management will address four classes of water, as defined below:

- Stream Bypass Non-Contact Water: Water resulting from bypass pumping up to the design stream flow around the work area. This water will not contact impacted material;
- Stream Flood Water. Stream flood flow that is allowed to pass through the work area, with best management practices securing the work areas before the flood and limiting the potential erosion of impacted sediment from the work area;
- Construction Contact Water. Rainfall, stormwater, and/or groundwater that comes into contact with the contaminated soil or sediment in the work area, as well as the rehandling, processing, and loading areas. This includes wash and decontamination water; and
- Construction Non-Contact Water. Rainfall, stormwater. and/or groundwater that does not come into contact with the contaminated soil and sediment in the work area (such as in the habitat restoration areas where confirmatory sampling has been performed).

4.2.6.2 Non-Contact Water

Stream bypass water and construction non-contact water will be managed together. These two classes will be directly pumped around the remediation area and discharged to Dicks Creek downstream of the downstream dam (Figure 4-1).

4.2.6.3 Contact Water Treatment

Construction contact water will be pre-treated as necessary (see Section 6.2) and then pumped to the on-site water treatment system (Figure 4-1). Water treatment will include oil/water separation, bag filters to remove particulates, and activated carbon to adsorb any PCBs (Attachment 2). The treated water flows will be monitored for PCBs weekly during normal flow conditions and daily during demobilization events. The majority of the time, construction contact water will be pumped directly to the water treatment system; however, occasional circumstances (e.g., system maintenance, exceptionally high volumes) may require that construction contact water is temporarily stored in on-site fractionation tank(s).

Stream flood water will be allowed to pass through the system as described in Sections 4.2.4 and 4.2.6. Once flows have reduced following a storm event, the stream flood water within the remediation area will be managed as construction contact water.

4.2.6.4 Discharge to Dicks Creek

The Monroe Ditch non-contact water (including stream bypass water), Dicks Creek/Outfall 002 non-contact water (including stream bypass water), and treated Monroe Ditch/Dicks Creek contact water will be piped to a single discharge point.

The contact and non-contact water will be discharged to Dicks Creek via diffusers (Attachment 2) to reduce sediment disturbance. Monitoring stations will be located upstream and downstream reasonably close to the intake and outlet but where turbulence is not influenced by pumping and normal in stream flow regimes exist. Turbidity will be monitored daily during in stream operations and daily during demobilization events to ensure that turbidity values are in accordance with the Ohio EPA Conditions for the Nationwide 38 Permit. When the background turbidity is 40 nephelometric turbidity units (NTU) or less, discharge water turbidity shall not exceed 10 NTU over background turbidity. When the background turbidity is greater than 40 NTU, discharge water turbidity shall not have more than a 25% increase in turbidity above upstream background levels. During demobilization events water leaving the construction area should not have increased turbidity by more than 50% of upstream values and be free of increases in contaminants of concern. When an exceedance of these criteria occur, immediate corrective actions will be taken (e.g., decrease water velocity/turbulence at the discharge, install turbidity barrier downstream of the diffusers). A violation of these criteria will be considered to have occurred when more than three exceedances of the turbidity criteria occur within seven consecutive measurements during in stream operations or more than three exceedances of the turbidity or one exceedance of the chemical criteria occur during demobilization events. Should AK Steel be unable to attain these criteria after applying reasonable controls as determined by the regulating agency, these criteria may be modified by the regulating agency. Any additional monitoring required in the National Pollution Discharge Elimination System (NPDES) permit will be conducted as specified in the permit.

4.2.7 Confirmatory Sampling

4.2.7.1 Interim Measure 2 and 4.C: Excavation of Floodplain Soil in Dicks Creek Reach 1

After each floodplain grid cell is excavated, confirmatory sampling and testing will be completed. A single three-point composite sample will be collected from within each floodplain grid cell. The top six inches of material will be collected at each of the three discrete sample points and placed into a common pan for compositing. The composite sample will then be analyzed using USEPA method 4020 (Immunoassay). The sample results will be compared with cleanup goal (PCB concentration less than 5 mg/kg) per the interpretation criteria set up for the method. Acknowledging a deliberately conservative approach along with a desire to avoid off-site disposal of clean material, time delays, increased health and safety concerns, and unnecessary costs, a value of 4.0 mg/kg total

PCBs by Method 4020 is identified as the post-excavation confirmation value. This value resulted in approximately 5% false negatives and 20% false positives in the paired data set (number of samples = 268). At this level, the amount of material above the Action Limit would be overestimated, but this high degree of conservative bias would ensure the effectiveness of the cleanup.

To the extent practical, samples will be collected within a day of completing excavation of the cell to the design grades. Sample results are expected to be generated within 12 to 24 hours of submission to the testing lab. An on-site lab operated by Matrix will be used to minimize transportation time.

Maps depicting the results of confirmation sampling will be developed and provided to the contractor to provide guidance for additional excavation. These maps will be produced in both electronic and hard copy form. Electronic maps will be suitable for use with RTK-GPS equipment.

Removal is considered complete for floodplain grid cells when post-excavation elevations specified in the drawings (Attachment 2) have been achieved and confirmatory testing results meet the cleanup goal. Floodplain grid cells with testing results that exceed cleanup criteria will be excavated in approximate six inch depth increments (or deeper, as determined based on field conditions) and retested until confirmatory sampling meets cleanup criteria. If test result indicate that floodplain grid cells exceed TSCA criteria (i.e., >50 mg/kg), then the impacted grid cell will be excavated in approximate six inch depth increments (or deeper, as determined based on field conditions), managed as TSCA material, and retested until confirmatory sampling meets cleanup criteria.

Once confirmatory sampling indicates that a floodplain grid cell has met the cleanup goal, the cell will be immediately released for initiation of the restoration phase of the cleanup.

4.2.7.2 Interim Measure 6: Excavation of Sediment and Other Material in Monroe Ditch, Dicks Creek Reach 1, and Outfall 003.

No confirmatory sediment sampling is required for sediment excavation[16], as remediation is based upon removal of material to the elevation established by the site characterization and set forth in the remedial design. Sediment removal is considered complete when elevation monitoring confirms removal to the design elevation. Excavation areas that exceed the elevation criteria will require additional excavation until the excavation grades meet the design elevations.

Once design elevations have been confirmed in a subarea of the project, the subarea will be immediately released for initiation of the restoration phase of the cleanup.

[16] Confirmatory sampling will be collected at DC1-SC17A in accordance with the approval with conditions of the *Data Summary Report: Sediment Delineation*.

4.2.8 Backfill

Placement of clean backfill material within excavated areas will be performed as part of the restoration activities (Section 7). After confirmation procedures indicate a remediated area is complete, backfill material will be placed, as necessary, to re-establish appropriate grades and support habitat restoration. At least six inches of clean material will be used to cover existing floodplain soil (<5 mg/kg) and establish the final grade. Backfill material will be verified as clean prior to placement. Technical specifications for backfill characteristics and placement are provided in Attachment 1.

4.2.9 Work Sequencing

Excavation of floodplain soils and sediment will be completed during the same construction season for Dicks Creek Reach 1 and Monroe Ditch. The general construction sequence for Dicks Creek (including Outfall 002 and IM 4.C) will be as follows:

- Mobilize to the site (see Section 4.5.1);
- Begin excavation of grid cell areas at upstream limit of project;
- Excavate mapped TSCA material first in each area;
- Haul excavated TSCA material to staging area(s), possibly in off-road trucks, for stockpiling or transport to disposal facility;
- Then excavate to design grid cell elevations;
- Haul excavated material to staging area(s), possibly in off-road trucks, and place in staging area;
- Perform confirmatory sampling within grid cells;
- Re-excavate and re-perform confirmatory sampling, if necessary, until passing results are achieved;
- Power wash concrete liner, inspect for areas that require maintenance, and grout any cracks;
- Pump water from concrete liner power washing (considered construction contact water) to on-site water treatment system for treatment prior to discharge to Dicks Creek under NPDES permit;
- After remediation goals are met, immediately begin restoration including establishing final grade, soil stabilization, and seeding and planting (described in Section 7);
- Process material, as necessary to meet landfill specifications;
- Load material into trucks or rail cars;
- Transport to landfill; and

– Complete habitat restoration including bank stabilization and planting (described in Section 7).

4.3 Disposal of Excavated Material

Selected materials may be reused on-site as described below. Disposal of excavated materials will be at USEPA approved upland landfills. TSCA materials (>50 mg/kg PCBs) will be disposed at the Environmental Quality Company (EQ) Wayne Disposal Facility in Belleville, Michigan or an alternative disposal facility, as approved by USEPA. All other materials (>5 mg/kg, <50 mg/kg PCB) will be taken to Rumpke landfill in Cincinnati, Ohio. The landfills require that material must pass the paint filter test prior to acceptance. Depending upon project conditions, precipitation, and groundwater elevations relative to excavation depth, dewatering/treatment of material in the staging area(s) may be required. Landfill daily acceptance rates (approximately 1500 tons/day for Rumpke) are not anticipated to limit production rates. However, in the unlikely event that on-site daily production must be reduced due to landfill daily acceptance rates, AK Steel may petition the Ohio EPA for an increase in Rumpke's maximum allowable total acceptance rate.

4.3.1 Material Segregation/Rehandling

Large material (e.g., tree branches not in contact with soil) will generally be segregated from the sediment during the excavation process and stockpiled. Portions of trees that have not contacted soils may be reused as necessary as specified in Attachment 1.

Soils excavated from the mapped TSCA areas will be segregated and transported to Staging Area 2. At the staging area, TSCA-material will be stockpiled consistent with applicable TSCA regulations (see Section 4.4.1.2) and/or transported directly to the landfill (see Section 4.3.3). Soils from designated TSCA areas are assumed to be TSCA-regulated materials.

Materials excavated from the non-TSCA mapped floodplain areas will be stored in non-TSCA designated stockpiles within the designated staging areas and handled as non-TSCA waste.

4.3.2 Dewatering Excavated Soils and Sediments

Based on the results of the September 2008 test pit program, controlling stormwater, surface water, and groundwater during excavation will be a primary factor in efficiently meeting the paint filter test requirements for shipment to the landfill. For example, diverting groundwater, stormwater, and surface water away from the working face of the excavation and soil stockpiles should provide considerable benefit in meeting the paint filter test.

Floodplain excavations will be advanced, to the degree reasonably possible, in a manner that limits the amount of post-excavation dewatering required to meet the paint filter test. The methods will be modified in the field to adapt to changing site conditions (e.g., groundwater, stormwater, rainfall, soil grain size, available stockpile areas). Possible measures may include:

- Excavating and loading the relatively dry Surface Unit into trucks for direct haul to the landfill;
- Directing groundwater seepage from the Intermediate Unit away from the working face to limit the amount of water entrained into the excavated material;
- Segregating wet Intermediate Unit sandy materials during the excavation and stockpiling to take advantage of the free draining character of the material, resulting in shortened dewatering times to meet the paint filter test;
- Mixing of dryer Surface Unit soils with wetter Intermediate or Lower Unit soils to produce a blended material that meets the paint filter test;
- Addition of stabilizing agents (lime, gypsum, rice husks, cement, polymers, copolymers, diatoemaceous earth, fly ash and/or other products); and/or
- Other methods as developed during construction.

Each pile placed in the staging area will be covered at the end of each day and as necessary to minimize dust and contact with precipitation. Covers will be secured so as not to be functionally disabled by winds expected under normal seasonal meteorological conditions at the storage site. Water draining from the stockpiles, as well as rainfall on the active stockpile handling areas, will be captured and treated as construction contact water.

At this time, no special treatment/stabilization of the excavated soil and sediment is expected beyond those described above to meet the paint filter test. However, if necessary, the additional measures presented in Attachment 1 may be used.

The contractor shall comply with all applicable federal, state, and local regulations regarding handling and stockpiling materials, as specified in Attachment 1.

4.3.3 Transport/Haul

At Staging Area 2, the stockpiled soil and sediment will be loaded into trucks for delivery to either the local solid waste landfill (Rumpke) or to the TSCA landfill (EQ or an alternative disposal facility, as approved by USEPA) as appropriate. It is currently anticipated that the materials will be shipped by truck from the site to the landfill. Depending on staging and sequencing issues, some of the TSCA material may be shipped by rail to a TSCA landfill, as approved by USEPA.

Loading will occur in the following general sequence: Trucks will arrive on-site to be loaded. Trucks that will be transporting TSCA material to the disposal facility must be lined. A spotter/laborer will direct and position the empty truck immediately adjacent to the equipment performing the loading activity. The loading process will commence. As each bucket of material is placed in the truck, the spotter will be overseeing the activity. Trucks that will be transporting material off-site will be covered with tarps to minimize spillage and fugitive emissions.

During the loading process, any and all clods of soil or debris that fall in the loadout area will be immediately picked up and returned to the stockpile area. The spotter will be equipped with shovels and the necessary personal protective equipment (PPE) to manage this activity. If it is determined feasible and necessary, a temporary use material (geotextile or poly sheeting) will be deployed under the immediate swing radius of the bucket carrying soils from the stockpile to the awaiting truck. This material will be routinely cleaned off and replaced as necessary to facilitate a clean process.

The contractor shall comply with all applicable federal, state, and local regulations regarding transporting materials.

4.3.4 Waste Tracking Procedures

A waste profile form and manifest will be completed and submitted to the disposal facilities for each waste category. A manifest will accompany each load of waste taken off-site. Each shipment of waste will be thoroughly tracked and recorded (i.e., number of loads, dates of shipment, media shipped, and tonnage shipped). Signed manifests will be obtained from the receiving facility. Transportation and disposal of the non-hazardous waste will be tracked using the manifests/weigh tickets and will be coordinated with the AK Steel Project Coordinator or Project Manager. Similarly, TSCA regulated waste will be tracked with manifests and will be coordinated with the AK Steel Project Coordinator or Project Manager.

All project-related waste shipment records will be maintained on-site by the AK Steel Project Coordinator or Project Manager for inspection by either state or federal regulatory personnel during field oversight visits.

4.4 Site Preparation

4.4.1 Staging Areas

The staging area(s) (Figure 4-1) will be used for equipment storage, limited material storage and rehandling, and dewatering of the excavated material, if needed. The staging areas were selected based primarily upon availability (adjacent to the work area) and ability to secure access. All proposed staging area were evaluated based on the criteria established in the *Interim Measures Remediation Work Plan, Rev. 2* (ENVIRON 2008b). These criteria included:

- Minimize potential disturbance of habitat (preference given to locations in open fields rather than wooded areas);
- Minimize potential disturbance of surrounding community (preference given to locations that are not primarily residential neighborhoods);
- Distance from excavation/work area (preference given to locations that are close to remedial activities);
- Distance from staging area (goal was to locate staging area to serve a 1,500 to 5,000 foot stream segment);

- Proximity to access point (must be located directly adjacent to site access point); and
- Topography (preference given to flat areas).

There are two staging areas that will be used for the Dicks Creek Reach 1 floodplain soil excavation. They are described below.

4.4.1.1 Staging Area 1

Staging Area 1 is located south of Oxford State Road, extending to the north levee, in the vicinity of Outfall 002. It is a small narrow site, rectangular in shape, and approximately 3.8 acres in area. It is currently a grass field with some small scrub trees. Staging Area 1 will be used for temporary offices, field staff support and sanitary facilities, parking, equipment storage and laydown, and stockpiling of imported restoration materials. No contaminated materials will be stored or staged within Staging Area 1.

A personnel and equipment decontamination station will be located in the south end of Staging Area 1, to prevent any contaminated materials from the work area entering the staging area.

A two-way truck access road will be located along the western portion of Staging Area 1.

4.4.1.2 Staging Area 2

Staging Area 2 is located inside the slag processing area on the south side of Dicks Creek and is approximately three acres in area (Figure 4-1). Access to this staging area will be through the slag processing area, via the intersection of Oxford State Road and Slag Hauler Road. Existing slag material will be moved to prepare site for use. It will consist of a water management area, a stockpile area containing TSCA and non-TSCA cells, and a load-out area.

Off-road trucks will haul material from the work area (from the point of excavation) along the haul roads (described in Section 4.4.2) to Staging Area 2. Off-road trucks will enter the site from the north end (Attachment 2), dump excavated material into either the TSCA or non-TSCA cell, as applicable, and return to the remediation area. The TSCA and non-TSCA cells will be isolated from each other by an earthen berm. Both the TSCA and non-TSCA cells will be lined based on the following design considerations:

- A liner will be placed beneath the piles that is designed, constructed, and installed to prevent migration of wastes off or through the liner into the adjacent subsurface soil, groundwater, or surface water at any time during the active life of the staging area;
- The liner will be designed to have sufficient strength and thickness to prevent failure due to pressure gradients (including static head and external hydrogeologic forces), physical contact with the waste or leachate to which they are exposed, climatic conditions, the stress of installation, and the stress of daily operation;
- The liner will be placed on a prepared surface or base capable of providing support to the liner and resistance to pressure gradients above and below the

liner to prevent failure of the liner due to settlement, compression, or uplift; and

– The liner will be installed to cover all surrounding earthen material likely to be in contact with the stockpiled material.

The TSCA cell will be lined with at least a 20-millimeter (mm) thick polyethylene liner material.

Stormwater controls will consist of a bermed system constructed to prevent the run-on flow onto the stockpile during peak discharge from at least a 25-year storm. A water management area will be used for water management equipment staging, management of collected water from the water management sump area inside the footprint of the staging pads (Attachment 2). Any water collected from the staging area will be removed as soon as practical and managed as contact water (described in Section 4.2.6).

Each pile placed in the staging area will be covered at the end of each day to minimize dust and contact with precipitation. Covers will be secured so as not to be functionally disabled by winds expected under normal seasonal meteorological conditions at the storage site. A typical cross-section of the excavated material stockpile is included in the design drawings (Attachment 2). The entire stockpile area will be fenced as is required.

Loaders/excavators will process material, if required, to pass the paint filter test, transfer material to the loadout area on the south side of the staging area where the material is loaded into road trucks for transportation to the landfill. Trucks that will be transporting material off-site will be equipped with tarps to minimize spillage and fugitive emissions. After loading, on-road trucks will be visually inspected prior to leaving the site to prevent track-out of material.

Trucks waiting to be loaded will be staged in the load-out area. Based upon 200 to 1,000 CY production per day, 10 to 50 loaded trucks per day will be leaving Staging Area 2 (assuming 20 CY/truck).

Following project completion, Staging Area 2 will be sampled (as specified in Attachment 1) to confirm that the underlying material was not contaminated during construction.

4.4.2 Access and Haul Roads

Access to staging areas will primarily occur through existing roads. The main access to Staging Area 1 will be from Oxford State Road. Access to Staging Area 2 and the excavation area will occur through the existing Tube City IMS perimeter road. One access road extension will be required to modify an existing Tube City IMS perimeter road to run to the south and east of the aboveground storage tank (Attachment 2).

The excavation areas will require the construction of new haul roads. The Dicks Creek haul roads will be constructed along the north and south levees in a phased approach to allow continuous, generally circular traffic flow through the 5 phase excavation sequence. The haul roads will be constructed during the site preparation for each excavation phase (Attachment 2). The traffic patterns are configured to control and minimize the linear distance of impacted material haul routes and as a safety feature by maintaining a generally one-way traffic pattern around each cell.

As each cell is completed, the northern haul road will be scraped and resurfaced to progressively extend the clean access into the next phased work area. The separation of clean and potentially contaminated haul roads will minimize potential cross-contamination. Following project completion, all transportation corridors will be sampled (as specified in Attachment 1) to confirm that haul roads were not impacted during construction.

Haul roads will be approximately 15-feet wide and will be constructed of aged slag (or equivalent) or aggregate (2.5 inches or smaller). The haul road sub base will be prepared by removing vegetation and soft, unstable soils. The prepared surface will be proof rolled and compacted as necessary. Depending on subsurface conditions, haul roads may be constructed using 8 ounce (oz) non-woven geotextiles or geogrids necessary to stabilize soft areas. Geotextiles and geogrids will be overlain with a minimum 4 inch lift of compacted slag (or equivalent) of a gradation suitable for the application. Lift thickness and material gradation may be adjusted as necessary to ensure a stable road base is constructed.

4.4.3 Soil and Sediment Erosion Control

ENVIRON has prepared a stormwater pollution prevention plan (SWP3) (Attachment 8) specifically addressing soil and sediment erosion control measures in remediation and staging areas (including the stockpile and rehandling areas). Stockpiles of impacted soil will be covered at the end of each day and as necessary to minimize dust and prevent erosion. The SWP3 also provides details on temporary stabilization of any potentially impacted material exposed in the excavation area for storm flow through project area.

4.4.4 Decontamination Areas

Project controls are established to ensure contaminated material is not tracked off site. The decontamination areas will be one-way drive through stations located at each of the excavation work area exits into Staging Area 1 and Staging Area 2 (Attachment 2). The decontamination pad will be positioned atop a 6 inch sand layer. The decontamination pad base will be covered with a 20 thousandths of an inch (mil) high density polyethylene (HDPE) over and underlain with 8 oz. non-woven geotextile. A 3 inch or larger aggregate based with a sand bottom will be graded towards the sump in one corner of the decontamination area. A bridge mat (at least 8 inches thick, 4 feet wide, and 20 inches long) will be placed on top of the aggregate. Both the entry and exit will be stabilized. The perimeter will be bermed and a geotextile and T-post fence will be placed outside of the berm to control overspray.

4.4.5 Noise Control

The remedial activities will involve conventional earthmoving equipment that is typically designed to meet Occupational Safety and Health Administration (OSHA) noise limits. The contractor will be required to keep all equipment in good working order, including noise suppressing mufflers. The AK Steel Project Coordinator and/or Manager will reserve the right to suspend work due to excess noise (as determined by OSHA requirements).

4.4.6 Particulate Matter Monitoring

The potential for airborne dust generation exists during the excavation of floodplain soils, hauling of excavated material to the rehandling and stockpile area, stabilization, rehandling into haul trucks, site regarding for restoration, and the placement of import materials for restoration.

The potential to generate dust during excavation will be limited and managed as necessary with typical construction dust control measures. These mechanisms may include: (1) applying water to equipment, vehicles, roads, or excavation faces; (2) restricting vehicle speeds; and (3) covering excavated areas and material after excavation activity ceases. Haul roads will be constructed and maintained to minimize dust generation during on-site transport. These roads will be sprayed with water when needed to control dust. During rehandling, water sprayers will be used as needed to control dust. Stockpiles will be covered at the end of each day and when necessary to prevent dust.

Potential to Emit (PTE) calculations have been completed to determine if any of the operations associated with the remediation activities (e.g., storage piles, paved and unpaved roadways, materials handling) trigger Ohio EPA's air permitting regulations. PTE calculations indicate that fugitive dust emissions from paved roadways, storage piles, and material handling will not exceed the permitting thresholds established under Ohio Administrative Code 3745-15-05 (i.e., 10 pounds per day [lbs/day]). However, PTE calculations for unpaved roadways indicate that emissions may exceed the permitting threshold established under Ohio Administrative Code 3745-15-05 (i.e., 10 lbs/day). Therefore, permit applications for coverage under the permitting regulations of Ohio EPA and Hamilton County Environmental Services (which serves Butler and Warren Counties) have been submitted.

The dust control and monitoring plan can be found in Technical Specification Section 01520 (Attachment 1).

4.5 Mobilization and Demobilization

4.5.1 Mobilization

The construction mobilization for Dicks Creek (including Outfall 002) will include the following steps:

- Set up field offices for contractor, AK Steel, and its representatives. Provide electricity, potable water, sanitary sewer, telephone, and data services as appropriate;
- Identify, locate, and mark underground utilities;

- Construct staging area(s), stockpiling areas, and decontamination areas including ingress and egress points, paving or surface stabilization, as appropriate, surface stormwater management and controls;
- Construct haul roads, including clearing of trees and shrubs as needed and excavation of any impacted material present within location of haul road, and placement of base course and surface course roadbed materials as appropriate;
- Install surface water, rain water, groundwater pumping and management equipment within the work area to satisfy the requirements of managing construction contact water;
- Install on-site water treatment system to process construction contact water;
- Excavate/install sump area and dam placement area;
- Install pumps and piping for stream bypass water;
- Install upstream dam and start bypass system;
- Extend Outfall 002 temporarily to discharge outside the work area;
- Install downstream dam;
- Establish locations for turbidity monitoring both upstream and downstream of the work area; and
- Install and maintain erosion and sediment controls.

Mobilization activities will take on the order of four to six weeks to complete. Based on an excavation start of June 1, 2009, the mobilization should be initiated between mid April and the first of May 2009 to have the facilities ready for the scheduled start date.

4.5.2 Demobilization

Demobilization will involve the following steps:

- As necessary, stabilize the downstream extent of the 2009 remediation work area and tie-into the existing slopes that will be addressed in the 2010 remedial phase;
- Clean and decontaminate staging areas and re-establish normal stormwater and surface water flow;
- Clean and decontaminate haul roads;
- Conduct confirmatory sampling of surface material in all transport corridors, material handling areas and stockpile areas to ensure no PCB contamination was released during the operation;
- Remove and decontaminate surface water, rain water, groundwater pumping and management equipment within the work area;
- Remove and decontaminate exterior of pumps and piping for stream bypass water;

- Install temporary upstream dam;
- Remove upstream earthen dam and restore dam location;
- Remove downstream dam;
- Return flow of Outfall 002 to original configuration;
- Remove temporary upstream dam and bypass pumping system;
- Remove and decontaminate water treatment system for construction contact water;
- Remove surface water monitoring equipment from upstream and downstream locations; and
- Removal of field offices for contractor, AK Steel, and its representatives.

Demobilization activities will take approximately four to eight weeks to complete. Depending on the weather restrictions, some of the demobilization may be delayed until the spring following November scheduled completion of the remediation. Alternately, some facilities may remain in place to support the 2010 remedial construction, as appropriate.

4.6 Permits

Access agreements with property owners will be required in remedial areas that are located on land not owned by AK Steel. In addition, an access agreement will be required for all remedial activities that will occur under or adjacent to the Norfolk-Southern railroad tracks.

In addition to access agreements, sediment excavation of may require the following permits:

- Pre-construction notification of United States Army Corps of Engineers (USACE) under USACE Nationwide Permit (NWP) 38;
- Ohio EPA NPDES permit and a PTI for the water treatment and discharge system;
- Notice of Intent for coverage under the Ohio EPA General Construction Activity Storm Water Permit;
- Ohio EPA Air Permit to Install and Operate; and
- An AK Steel dig permit for excavation on AK Steel property. In addition an AK Steel confined space entry permit will be required for anyone who enters the excavation hole(s).

Ohio EPA has determined that certification pursuant to Section 401 of the Clean Water Act is not required.

5.0 MONROE DITCH – EXCAVATION OF SEDIMENT AND OTHER MATERIALS (IM 6) DESIGN

The excavation of the Monroe Ditch sediment (IM 6) will be closely coordinated with the MDA-33S remediation (IM 3). In addition, a new bridge will be constructed over Monroe Ditch at the upstream end of project to provide access to the MDA-33S containment and treatment system and adjacent area and the existing culvert bridge/sheetpiling at the downstream end of project will be removed. The Monroe Ditch sediment excavation will be done concurrent with or ahead of Dicks Creek Reach 1. However, the remediation of the portion of Dicks Creek located downstream of the confluence of Monroe Ditch and Dicks Creek will be conducted after the Monroe Ditch remediation.

5.1 Design Basis

Monroe Ditch is a narrow, steep banked stream with limited access and landfills on two sides. As discussed in Section 1.1, the Monroe Ditch remediation area begins at three culverts under the railroad and ends at the confluence with Dicks Creek. The Monroe Ditch stream bed is composed of sand and fine gravel sediment as well as boulders, cobbles, trees, and debris. The sand and fine gravel sediment is fully saturated and overlies native clay.

Monroe Ditch remediation includes the removal of all sediment and native material in the channel to a specified elevation established based upon sampling, probing, and mapping by ENVIRON. Excavated material will be disposed of at off-site landfills.

5.1.1 Design Constraints

There are many significant design constraints that require consideration and evaluation in developing an effective design approach for Monroe Ditch remediation. The primary design constraints for the Monroe Ditch remediation are:

- Access. There is no direct off-site access into Monroe Ditch. All equipment, labor, import materials, and excavated materials must go through the slag processing area to access Monroe Ditch. Much of Monroe Ditch is bordered by steep side banks that are heavily vegetated with trees, which makes access to the ditch difficult. The stream bed itself is currently the only access corridor along the length of the ditch. There is no access or haul road adjacent to the ditch that can be used for material hauling after excavation.
- Debris, Boulders, and Trees. Monroe Ditch contains boulders, cobbles, trees, and debris overlying and intermixed with the sediment to be removed.
- Cannot Increase Upstream Flooding. The proposed remediation cannot create increased upstream flooding during construction, so any blockage structures must be removable during flood events or full flood flow capacity must be provided by the bypass system.

- MDA-33S. Remediation of MDA-33S occurs along the bank of Monroe Ditch and involves the removal of TSCA level materials and seeps containing free product followed by the installation of a containment and treatment system, which could interfere with the Monroe Ditch work. The design of MDA-33S is described in Section 6.
- Currently Existing Interceptor Trench. There is a groundwater interceptor trench located on the east side of the ditch in the vicinity of Stations 20+25 to 23+25, which shall not be disturbed or damaged.
- Existing Culvert/Bridge to be Removed. The existing culvert/bridge, which is currently the only access across Monroe Ditch, will be removed as part of the remediation.

5.1.2 Design Strategy

The primary design strategies at Monroe Ditch are:

- Impacted Material Required for Removal. The consent decree requires all impacted sediment and underlying native material be removed from Monroe Ditch.
- Mechanical Excavation in the Dry[17]. The impacted sediment will be removed using excavators and haul trucks or similar equipment.
- Access. The flow of Monroe Ditch will be bypassed around the work area and construction equipment access (excavators, trucks) will be primarily down the dewatered steam bed.
- Flash Floods. The bypass pumping system will be designed to handle the base flow up to a design level storm, with the excavated area stabilized and the channel evacuated for major storm events.
- Boulders and Debris. The Monroe Ditch sediment removal will be completed with excavators capable of handling the boulders, cobbles, trees, and debris found in the channel as well as removing the impacted sediment.
- MDA-33S. The MDA-33S work will be coordinated with the Monroe Ditch work, completing the MDA-33S bank work in conjunction with the adjacent Monroe Ditch excavation. Construction of the MDA-33S containment and treatment system will continue as the Monroe Ditch excavation progresses downstream.
- New Bridge. The new bridge to cross Monroe Ditch is being designed by R.E. Warner & Associates (Attachment 2) and will be constructed in the vicinity of Station 30+50 to 31+00.

[17] Contractor equipment and expertise may allow the selection of an alternate sediment removal method (e.g., sediment vacuum) for certain areas, as approved by USEPA.

The bypass pumping approach includes installing a dam across the Monroe Ditch stream channel at the upstream end of the project. The downstream dam in Dicks Creek will be installed downstream of the confluence of Monroe Ditch and Dicks Creek, serving both waterways. A sump will be constructed near station 32+30 downstream of the three culverts that run under the railroad. The upstream dam will be installed downstream of the sump. Multiple pumps will be required to reroute the Monroe Ditch flow around the work area and return it downstream of the Dicks Creek downstream dam. Groundwater management will still be required and sediment may need dewatering/treatment to meet paint filter test criteria.

5.1.3 Preferred Design Approach Summary

The preferred design approach for Monroe Ditch is based on bypass pumping of the base flow and flow up to design level storm event, stabilizing the excavation working face, and evacuating the work area during significant storm flows. The stream bed will serve as the primary access to the work area, with occasional access points constructed on the bank of Monroe Ditch. Mechanical excavator(s) located in the center of the ditch will excavate the sediment and place the excavated material directly into the dry channel. A long-reach excavator located on the bank will then retrieve the material and directly load to an off-road 25-ton or 40-ton articulating dump truck for delivery to Staging Area 2. This method is the most productive, but also has the additional benefit of avoiding a secondary ground placement and thus preventing cross-contamination or waste volume increase. The construction season will be limited to between June 1 and November 30, the period of the lowest average monthly flow in the creek.

The design bases for excavation of sediment in Monroe Ditch are discussed in detail in the following subsections for the following key remedial elements:

- Mechanical excavation of sediment will be completed in the dry;
- Bypass pumping will be used to reroute Monroe Ditch flow around the work area;
- Groundwater will be controlled with surface drainage, well points, and pumps;
- TSCA materials (>50 mg/kg PCBs), associated with MDA-33S, will be excavated prior to other materials (>5 mg/kg PCBs and <50 mg/kg PCBs) in all cells; and
- Excavated materials will be loaded into appropriately prepared trucks and hauled to landfill.

5.2 Excavation Design

The Monroe Ditch excavation will be implemented in three phases – pre-MDA-33S, MDA-33S, and post MDA-33S (Attachment 2). Excavation will include the removal of all sediment and other native material beginning upstream and proceeding downstream.

TSCA excavated material will be loaded into trucks and transported to Staging Area 2. At the staging area, TSCA-material will be stockpiled consistent with applicable TSCA regulations (see Section 5.5.1) and/or transported directly to the landfill (see Section 5.3.3).

Non-TSCA excavated material will be loaded into off-road haul trucks for on-site transport to Staging Area 2 where the material will be stockpiled, processed as necessary to meet the paint filter test, and rehandled into on-road trucks for transport to the landfill.

5.2.1 Excavation Footprint

Excavation footprints for TSCA and non-TSCA material were determined by the methods described in the following subsections.

5.2.1.1 TSCA Material Excavation

The MDA-33S Phase of Monroe Ditch excavation incorporates the removal of Monroe Ditch floodplain soil determined to exceed TSCA regulations, per 40 CFR 761.61(c)[18], as part of the MDA-33S remediation. Free product, associated with MDA-33S, has been determined to contain PCBs exceeding 50 mg/kg. Laterally, the north-south extent of the free product has been delineated through investigative borings, extending with 75 feet north of MDA-33S and 375 feet south of MDA-33S. Vertically, the free product is isolated to a 1- to 3-foot thick sand layer situated atop a clay layer which acts as a lower confining layer. A previous site investigation demonstrated that the soil above and below this sand layer contains <5 mg/kg PCBs (ARCADIS 2002).

The TSCA Cleanup Surface extends from 75 feet north of MDA-33S to 375 south of MDA-33S and is inclusive of the entire extent of the sand layer, approximately one foot over the overlying material, and approximately six inches of the upper clay surface. The eastern extent of this material is defined by Monroe Ditch and the western extent is defined by the design of the MDA-33S treatment system (see Section 6). The TSCA Excavation Surface will be adapted for the capabilities of mechanical equipment excavation to produce the design prism (TSCA Excavation Surface) allowing stable side slopes (1:1) to the existing grade (daylighting boundaries).

The excavation of TSCA material will advance below the sand layer approximately six inches into the clay surface. TSCA excavation will be extended to include any oily material encountered beyond the TSCA Cleanup Surface, as verified by PID readings exceeding 300 parts per million (ENVIRON 2007b). Overburden material (down to approximately one foot above the sand layer) will be excavated and managed with the non-TSCA material. Further excavation of any underlying non-TSCA material may be necessary to reach the elevations remedial design drawings for the MDA-33S treatment system (Attachment 2). The volume of material to be removed for the MDA-33S remediation is approximately 1000 CY, including 460 CY of TSCA-material.

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[18] An application for the risk-based disposal of Dicks Creek and Monroe Ditch PCB remediation waste was submitted by letter to the USEPA Acting Regional Administrator for Region 5 on February 12, 2009. Attached to the application, a certification signed by the Owner identifies where all sampling plans including sampling and analysis procedures, related this remediation effort are on file.

5.2.1.2 Non-TSCA Material Excavation

The Consent Decree required that all mapped sediment be removed from the work area. Therefore, the remediation footprint associated with IM 6 extends to the nearest floodplain boundary (e.g., Dicks Creek, Monroe Ditch, concrete liner, or bedrock). No removal is required in areas of bedrock or cobble/gravel, as delineated in the data summary report (ENVIRON 2006d). No bedrock will be excavated. The excavation footprint is contained within the stream bed. The sediment excavation will be advanced to elevations established by the site characterization and set forth in the design drawings. The establishment of pre-excavation permanent elevation benchmarks and survey control points, compliance surveys of the excavation depths and dimensions (via RTK-GPS rover), and post-restoration surveys that will be used to create as-built final reports will all be performed in compliance with the technical specifications (Attachment 1).

In order to stabilize the adjacent stream banks until restoration can be completed, a 1:1 side slope will be excavated as needed. Soil excavated from the eastern bank of Monroe Ditch as part of the construction of the MDA-33S containment and treatment system will be stockpiled in Staging Area 2 for testing and possible non-restoration reuse by AK Steel (Technical Specification 01060, Attachment 1).

The calculated volume of the Cleanup Surface containing the material to be removed from Monroe Ditch is 2,400 CY, which does not include slopes for daylighting or stability. This includes material within Monroe Ditch from the upstream limit of the concrete liner in Monroe Ditch to the upstream limit of the project area.

5.2.2 Design Flow

Flash flooding does occur in Monroe Ditch due to major storm events. The construction activities cannot exacerbate flooding conditions upstream of the project area. The bypass pumps can divert the Monroe Ditch average annual flow of 8 cfs (3,800 gpm); however, providing pump capacity for the larger storm events is not practical. The bypass flow capacity was selected by considering the exceedance probability and project impacts. This system will have a minimum capacity of 14 cfs (6,500 gpm) and is presented in detail in Section 5.2.5.

Table 5-1 shows the probability of exceedance for bypass systems sized to specified flows. Table 5-1 is correlated with Table 4-1 (Dicks Creek flows) as work in Monroe Ditch will be stopped for high flows when Dicks Creek work is stopped. As a result, the bypass pumping design for Monroe Ditch will be correlated to Dicks Creek.

5.2.3 Groundwater and Precipitation

Groundwater flow will be controlled using standard dewatering wells and pumps (Attachment 2). The construction period of June through November is during generally falling groundwater elevations, again reducing the potential groundwater flow impacts. Any groundwater collected within the excavation area that may have come into contact with impacted soil/sediment (construction contact water) will be pumped to the water treatment system to be treated and discharged as described in Section 4.2.6.

Analysis of historical precipitation data and stream flow modeling by ENVIRON correlated stream flow and precipitation probabilities (Attachment 6). Stormwater that comes into contact with the impacted soil/sediment and falls into the dewatered work area or staging area will be treated as construction contact water and pumped to the water treatment system to be treated and discharged as described in Section 4.2.6.

5.2.4 Weather Escalation Plan

Due to the potential for significant flow events during severe weather, a detailed plan of weather monitoring, action levels, and associated protocols is provided as Attachment 7. The plan describes a real time weather prediction protocol for the site 24 hours per day, 7 days per week. The contractor will also have ability to stabilize Monroe Ditch excavation areas and manage dam 24 hours per day, 7 days per week including during hours that remediation work is not actively being performed (including holidays).

Weather conditions will determine the action level, which dictates if additional evacuation steps are necessary. If a storm event is anticipated that is expected to exceed bypass pump capacity, the flow will be allowed to pass through the site. It is significant to note that the increase in flow in Monroe Ditch at two times the average annual discharge is less in proportion to that of Dicks Creek at the same rate (Attachment 5). As such, it may be that there will be greater latitude in being able to continue to work in the Monroe Ditch channel, when work may be shut down in Dicks Creek.

5.2.5 Equipment

The materials and equipment necessary for this design are provided in Table 4-2. Additional details for the dam, bypass pumps, piping, and trucks are provided in the following subsections.

5.2.5.1 Dam

Super Sack dam bags will be placed at the upstream end of the work area near the railroad culverts (i.e., Station 31+85). The downstream end of Monroe Ditch will not be dammed, but will instead rely on the dam at the downstream end of the Dicks Creek project area (see Section 4.2.5.1) to prevent backflow from entering Monroe Ditch. Super Sack coffer dams have been successfully used in similar applications. Super Sacks are constructed of woven polypropylene and can be filled with sand and wrapped with low density polyethylene (LDPE) or similar to create a stable coffer dam. This system allows the coffer dam to be customizable to any configuration and height, accommodating variable river depths and irregular river beds. Construction details for the installation of the dam bags are provided in Attachment 2. They can be rapidly removed (2 to 4 hours) from the floodplain in anticipation of flooding, if necessary.

5.2.5.2 Bypass Pumps and Piping

In order to provide capacity for both the average annual flow of 8 cfs (3,800 gpm) with periods of no flow in the summer and a design flow[19] of 16 cfs (7,200 gpm), at least two 12 inch bypass pumps will be used (Attachment 2). Each pump will have an optimal pumping capacity of 15 cfs (6,900 gpm) and a site-specific pump rating of 9 cfs (4,200 gpm) (Table 5-2). Additionally one 12 inch emergency back up pump will be on-site for use as: (1) a replacement to be utilized in the event of a pump failure during a peak flow or; (2) to supplement the bypass system to better manage those storm events at or slightly above the anticipated overflow criteria established.

Because of the very low base flow conditions in Monroe Ditch, 0 to 8 cfs (0 to 3,800 gpm), a sump will be constructed where Monroe Ditch enters the project, to collect water and allow proper and efficient pump operations.

The pumps will be located adjacent to the sump area, on the east side of the ditch, at approximately 645 feet above mean sea level. The pumps will be mounted on skids or trailers that can be easily moved in the event of anticipated flooding. The discharge piping will be laid along the alignment shown in Figure 4-1 generally following the railroad right-of-way around the landfill/slag processing area.

5.2.5.3 Excavation Equipment

The Monroe Ditch excavation will be implemented using multiple excavators and bulldozers. At least one long reach excavator (60 feet boom and stick) will be available for loading from the bank.

5.2.5.4 Trucks/Haulers

Off-road 25 ton or 40 ton articulating dump trucks will be used to transport materials on-site. Due to the limited access in Monroe Ditch, small specialty haul vehicles (such as morookas or similar) may be used. All haul trucks will be labeled with placards to identify whether they are designated to haul TSCA or non-TSCA materials. Vehicles should not switch between TSCA and non-TSCA transport without decontamination being completed.

Before leaving the site, all off-site haul trucks will be equipped with tarps to minimize spillage and fugitive emissions. On-site haul trucks will be covered with tarps, as needed to control fugitive emissions based on weather conditions (e.g., windy days, water content of material).

5.2.6 Water Management

Water management will follow the same procedures detailed in Section 4.2.6.

[19] Bypass pumping design flow is based on twice the average annual flow.

5.2.7 Confirmatory Sampling

No confirmatory chemical sampling is required for sediment excavation, as remediation is based upon removal to pre-determined bed elevations. When the creek bed has been excavated to the required elevation and all sediment removed, remediation will be completed and the area is ready for restoration. Excavation areas that exceed the elevation criteria will require additional excavation until the excavation grades meet the design elevations. No bedrock will be excavated. Once the design elevations have been confirmed in a subarea of the project, the subarea will be considered immediately released for initiation of the restoration phase of the project.

5.2.8 Work Sequencing

Since Monroe Ditch enters Dicks Creek within the Reach 1 remediation area, remediation of Monroe Ditch must be completed prior to completion of the downstream end of Dicks Creek Reach 1 below the confluence to prevent recontamination of Reach 1. The Monroe Ditch excavation will start at the upper end of the project (at the three culverts under the railroad) and work downstream. Work between the culverts and the upstream dam will be performed at periods of low flow, using temporary diversions or pumping as necessary.

The construction sequence for Monroe Ditch will be as follows:

- Mobilize to the site (as described in Section 5.6);
- Field locate MDA-33S containment and treatment system;
- Clean out culverts (prior to the excavation of the sump area and dam placement area);
- Install the upstream dam and construct the sump;
- Install the bypass pumps and piping;
- Construct access roads to reach creek bed;
- Construct the wastewater pretreatment system;
- Start excavation at upstream end and proceed downstream to MDA-33S area;
- Initiate restoration activities at upstream end and proceed downstream to MDA-33S area;
- Install well points and MDA-33S dewatering pre-treatment system;
- Process excavated material as needed to pass paint filter test and load for transport to landfill;
- Complete removal of TSCA material at MDA-33S area, process and load for transport to TSCA landfill;

- Excavate and construct MDA-33S treatment system[20];
- Restore floodplain and relocated creek bed in vicinity of MDA-33S when MDA-33S construction complete;
- Continue Monroe Ditch excavation downstream of MDA-33S with processing of excavated material;
- Restore creek bed when work in a segment is completed and the next access point is reached;
- Construct new bridge at approximate Station 31+80 after restoration is complete in that section of Monroe Ditch;
- Remove large culvert and sheetpiling near Station 8+70 when Monroe Ditch excavation is complete to Dicks Creek;
- Excavate sediment overlying concrete liner in lower end of Monroe Ditch;
- Management of TSCA material in the vicinity of the mouth of Monroe Ditch overlying the concrete liner;
- Power wash the concrete liner after excavation;
- Collect wash water and manage as contact water;
- Inspect and repair liner as necessary; and
- Complete habitat restoration including bank stabilization and planting (Section 7).

5.2.9 Excavation of Material in the Vicinity of Railroad Culverts

Prior to construction of sump and upstream temporary dam, the material inside the three culverts under the railroad and the material between the three culverts and the downstream limit of the temporary dam will be removed.

The culverts will first be inspected and their existing conditions documented prior to sediment removal within the culverts. Each culvert will then be re-inspected and conditions documented following sediment removal.

Sediment removal within each culvert will be accomplished during a low flow period using temporary flow diversion such as sandbags. Each culvert will be isolated from the stream flow, such as by placing sandbags over culvert entrance. The sediment will be removed from the culvert using hand tools and then the culvert will be pressure washed. Sediment will be stockpiled in staging area and pressure wash water will be collected and

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[20] The MDA-33S treatment system work sequence is detailed in Section 6.2.6. It should be noted that the Ohio EPA Permit-to-Install issued for this treatment system will require Ohio EPA's inspection of the collection and treatment system.

treated on-site. When the remediation of the culvert is complete, then stream flow will be diverted from the next culvert and the process repeated.

After the remediation of the three culverts is complete, then the sediment between the three culverts and the downstream limits of the temporary dam will be removed. Water will be diverted and the work area isolated with pumps, sandbags, or other temporary means. Flow will be diverted into half the channel while the other half of the channel is being remediated in this area.

5.3 Disposal of Excavated Material

Selected materials may be reused on-site as described below. All materials not segregated for reuse will be rehandled for disposal at an off-site landfill. Depending upon project conditions, precipitation, and groundwater elevation relative to excavation depth, dewatering/treatment of excavated material may be required. Landfill daily acceptance rates (approximately 1500 tons/day for Rumpke) are not anticipated to limit production rates. However, in the unlikely event that on-site daily production must be reduced due to landfill daily acceptance rates, AK Steel may petition the Ohio EPA for an increase in Rumpke's maximum allowable total acceptance rate.

5.3.1 Material Segregation/Rehandling

Certain material (e.g., tree branches) may be segregated during the excavation process and stockpiled. Portions of trees that have not contacted soil may be reused during restoration (e.g., in floodplain brush dikes).

Soil excavated from the eastern bank of Monroe Ditch as part of the construction of the MDA-33S containment and treatment system will be stockpile in Staging Area 2 for testing and possible non-restoration reuse by AK Steel (Technical Specification 01060, Attachment 1).

Soils excavated from the free-product containing sand layer in the vicinity of MDA-33S will be segregated and transported to Staging Area 2. At the staging area, TSCA-material will be stockpiled consistent with applicable TSCA regulations (see Section 5.5.1) and/or transported directly to the landfill (see Section 5.3.3). Sediment excavated from the non-TSCA mapped sediment areas will be stored in non-TSCA designated stockpiles within the designated staging area and handled as non-TSCA waste.

The contractor shall comply with all applicable federal, state, and local regulations regarding handling, stockpiling and transporting materials.

5.3.2 Dewatering Excavated Sediment

Controlling stormwater, surface water, and groundwater during excavation will be a primary factor in limiting the amount of entrained water in the excavated sediment. Diverting groundwater, stormwater, and surface water away from the working face of the excavation and soil stockpiles should provide considerable benefit in meeting the paint filter test.

Each pile placed in the staging area will be covered at the end of each day and as necessary to minimize dust and contact with precipitation. Covers will be secured so as not to be functionally disabled by winds expected under normal seasonal meteorological conditions at the storage site. Water draining from the stockpiles as well as rainfall on the active stockpile handling areas will be captured and treated as construction contact water.

At this time, no special treatment/stabilization of the excavated sediment is expected beyond those described above to meet the paint filter test. However, if necessary, the additional measures presented in Attachment 1 may be used.

5.3.3 Transport/Haul

At Staging Area 2, the stockpiled sediment will be loaded into trucks for delivery to either the local solid waste landfill (Rumpke) or to the TSCA landfill (EQ or an alternative disposal facility, as approved by USEPA) selected for the project. It is currently anticipated that the materials will be shipped by truck from the site to the landfill. Depending on staging and sequencing issues, some of the TSCA material may be shipped by rail to a TSCA landfill, as approved by USEPA.

Loading will occur in the following general sequence: Trucks will arrive on-site to be loaded. Trucks that will be transporting TSCA material to the disposal facility must be lined. A spotter/laborer will direct and position the empty truck immediately adjacent to the equipment performing the loading activity. The loading process will commence. As each bucket of material is placed in the truck, the spotter will be overseeing the activity. Trucks that will be transporting material off-site will be covered with tarps to reduce spillage and fugitive emissions.

During the loading process, any and all clods of soil or debris that fall in the loadout area will be immediately picked up and returned to the stockpile area. The spotter will be equipped with shovels and the necessary PPE to manage this activity. If it is determined feasible and necessary, a temporary use material (geotextile or poly sheeting) will be deployed under the immediate swing radius of the bucket carrying soils from the stockpile to the awaiting truck. This material will be routinely cleaned off and replaced as necessary to facilitate a clean process.

The contractor shall comply with all applicable federal, state, and local regulations regarding transporting materials.

5.4 Other Design Elements

5.4.1 MDA-33S Remediation Design

The MDA-33S containment system will be installed within the excavated area of Monroe Ditch between Stations 25+00 and 30+00. The remedial design of MDA-33S is presented in Section 6.

5.4.2 Bridge Construction at Station 31+80

As part of the remediation, the existing large culvert pipe and land bridge near station 8+70, which are the only existing means of crossing Monroe Ditch to reach the landfill area and the MDA-33S area, will be removed. This will require the construction of a new bridge to access these areas and support the operation and maintenance of the MDA-33S treatment system. The proposed bridge was designed by R.E. Warner & Associates and is presented in Attachment 2.

Excavation activities in Monroe Ditch will start at the upstream end. A temporary ditch crossing (see Attachment 2) will be constructed downstream of the dam on Monroe Ditch. Once excavation has proceeded downstream of the proposed bridge corridor, and that area is released for restoration, bridge construction will begin.

5.4.3 Large Culvert and Sheetpiling Removal at Station 8+70

Access across Monroe Ditch is currently via an earthen fill over and around a large (approximately 10-foot diameter) steel culvert, the "land bridge." On the downstream side there is a short section of steel sheetpiling on the south side of Monroe Ditch that is helping to support the approach and side slope. As part of the remediation, the earthen fill, the culvert pipe, and the sheetpile wall will be removed to a depth of one foot below grade or excavation bottom. Soil excavated from above the culvert will be stockpiled for testing and possible on-site non-restoration reuse by AK Steel. Material from alongside the culvert and behind the sheetpile wall will be handled as impacted material and sent with the excavated sediment for landfill disposal. The steel culvert and sheetpiling will be recycled.

Because this is the only current access across Monroe Ditch, the land bridge will not be removed until all other excavation in Monroe Ditch is complete or when the new bridge is operational, whichever occurs first. Remediation will proceed from the upstream end of Monroe Ditch down to the land bridge, then from the land bridge down to Dicks Creek. After this remediation is complete, the large culvert, fill, and sheetpiling comprising the land bridge will be removed.

5.4.4 Waste Tracking Procedures

A waste profile form and manifest will be completed and submitted to the disposal facilities for each waste category. A manifest will accompany each load of waste taken off-site. Each shipment of waste will be thoroughly tracked and recorded (i.e., number of loads, dates of shipment, media shipped, and tonnage shipped). Signed manifests will be obtained from the receiving facility. Transportation and disposal of the non-hazardous waste will be tracked using the manifests/weigh tickets and will be coordinated with the AK Steel Project Coordinator or Project Manager. Similarly, TSCA regulated waste will be tracked with manifests and will be coordinated with the AK Steel Project Coordinator or Project Manager.

All project-related waste shipment records will be maintained on-site by the AK Steel Project Coordinator or Project Manager for inspection by either state or federal regulatory personnel during field oversight visits.

5.5 Site Preparation

5.5.1 Staging Areas

Staging areas will be used for equipment storage, limited material storage and rehandling, and dewatering of the excavated material, if needed. The staging areas were selected primarily based upon availability to the work area and ability to secure access. Staging Areas 1 and 2, described in Section 4.4.1 and shown in Figure 4-1 will be used to support Monroe Ditch remediation. It is anticipated that excavated materials will be hauled to Staging Area 2 for processing if necessary to meet landfill specifications, and rehandling to off-site haul trucks. Restoration materials may be stockpiled in Staging Area 1 prior to placement in the ditch. Excavated material that may be reused will be stockpiled in Staging Area 2 until analytical sampling confirms that the material may be reused (testing specifications provided in Attachment 1). Following project completion, Staging Area 2 will be sampled (as specified in Attachment 1) to confirm that the underlying material was not contaminated during construction.

5.5.2 Access and Haul Roads

Access to staging areas will primarily occur through existing roads. The main access to Staging Area 1 will be direct access to Oxford State Road. Access to Staging Area 2 and the excavation area will occur through the existing Tube City IMS perimeter road. One access road extension will be required to modify an existing Tube City IMS perimeter road to run to the south and east of the aboveground storage tank (Attachment 2).

Monroe Ditch excavation will utilize the existing perimeter and landfill access roads. One access road extension will be required to join the landfill access road to the Dicks Creek access road. Additionally, an access road spur will be added to assist with the bridge construction.

Haul roads will be approximately 15-feet wide and will be constructed of aged slag (or equivalent) or aggregate (2.5 inches or smaller). The haul road sub base will be prepared by removing vegetation and soft, unstable soils. The prepared surface will be proof rolled and compacted as necessary. Depending on subsurface conditions, haul roads may be constructed using 8 oz non-woven geotextiles or geogrids necessary to stabilize soft areas. Geotextiles and geogrids will be overlain with a minimum 4 inch lift of compacted slag, aggregate, or equivalent of a gradation suitable for the application. Lift thickness and material gradation may be adjusted as necessary to ensure a stable road base is constructed.

Following project completion, all transportation corridors will be sampled (as specified in Attachment 1) to confirm that haul roads were not impacted during construction.

5.5.3 Soil Erosion Control

ENVIRON has prepared a SWP3 (Attachment 8) specifically addressing the soil and sediment erosion control measures in remediation areas (including the stockpile and rehandling areas). Stockpiles of impacted soil will be covered at the end of each day and as necessary to minimize dust and prevent erosion.

5.5.4 Decontamination Areas

The project controls and decontamination processes described in Section 4.4.4 will be used for the Monroe Ditch remediation implementation.

5.5.5 Noise Control

The remedial activities will involve conventional earthmoving equipment that is typically designed to meet OSHA noise limits. The contractor will be required to keep all equipment in good working order, including noise suppressing mufflers. The AK Steel Project Coordinator and/or Manager will reserve the right to suspend work due to excess noise (as determined by OSHA requirements).

5.5.6 Particulate Matter Monitoring

The potential for airborne dust generation exists during excavation activities, hauling of excavated material to the rehandling and stockpile area, stabilization, rehandling into haul trucks, site regarding for restoration, and the placement of import materials for restoration.

The potential to generate dust during excavation will be limited and managed as necessary with typical construction dust control measures. These mechanisms may include: (1) applying water to equipment, vehicles, roads, or excavation faces; (2) restricting vehicle speeds; and (3) covering excavated areas and material after excavation activity ceases. Haul roads will be constructed and maintained to control dust generation during on-site transport. These roads will be sprayed with water as required to control dust. During rehandling, water sprayers will be used as needed to control dust. Stockpiles will be covered at the end of each day and whenever necessary to prevent dust.

PTE calculations have been completed to determine if any of the operations associated with the remediation activities (e.g., storage piles, paved and unpaved roadways, materials handling) trigger Ohio EPA's air permitting regulations. PTE calculations indicate that fugitive dust emissions from paved roadways, storage piles, and material handling will not exceed the permitting thresholds established under Ohio Administrative Code 3745-15-05 (i.e., 10 lbs/day). However, PTE calculations for unpaved roadways indicate that emissions may exceed the permitting threshold established under Ohio Administrative Code 3745-15-05 (i.e., 10 lbs/day). Therefore, permit applications for coverage under the permitting regulations of Ohio EPA and Hamilton County Environmental Services (which serves Butler and Warren Counties) have been submitted.

The dust control and monitoring plan can be found in Technical Specification Section 01520 (Attachment 1).

5.6 Mobilization and Demobilization

The mobilization and demobilization activities are described in detail in Section 4.5, covering both Dicks Creek work and Monroe Ditch.

5.7 Permits

Access agreements with property owners will be required in remedial areas that are located on land not owned by AK Steel. In addition, an access agreement will be required for all remedial activities that will occur under or adjacent to the Norfolk-Southern railroad tracks (e.g., cleaning the culverts located beneath the railroad tracks).

In addition to access agreements, excavation of sediment may require the following permits:

- Pre-construction notification under USACE NWP 38 for sediment dredging in the Outfall 002 Channel and Dicks Creek;
- Ohio EPA NPDES permit and a PTI for the water treatment and discharge system;
- Notice of Intent for coverage under the Ohio EPA General Construction Activity Storm Water Permit;
- Ohio EPA Air Permit to Install and Operate; and
- An AK Steel dig permit for excavation on AK Steel property. In addition an AK Steel confined space entry permit will be required for anyone who enters the excavation hole(s).

Ohio EPA has determined that certification pursuant to Section 401 of the Clean Water Act is not required.

6.0 MDA-33S REMEDIATION

The installation of the groundwater containment and treatment system in the vicinity of MDA-33S (IM 3) will be closely coordinated with the removal of sediment from Monroe Ditch (IM 6).

6.1 Design Basis

A physical and hydraulic containment barrier with flow-through treatment cells is proposed as an IM for containing non-aqueous phase liquids (NAPL) and treating impacted groundwater emanating from the closed solid waste landfill adjacent to Monroe Ditch in the area of Monitoring Well MDA-33S.

Excavation of sediment from below Monroe Ditch is required to address PCB-impacted sediment. The proposed containment and treatment system will be constructed simultaneously during this excavation work at the western limit of the planned excavation. The proposed containment and treatment system will prevent the additional discharge of NAPL and groundwater containing PCBs to Monroe Ditch and prevent re-contamination of the sediment in the ditch and soil adjacent to the ditch.

6.1.1 Design Constraints

The primary design constraints for the Monroe Ditch remediation are:

- Access. There is no direct off-site access to MDA-33S and Monroe Ditch. All equipment, labor, import materials, and excavated materials must go through the slag processing area to access this area. Much of Monroe Ditch is bordered by steep side banks that are heavily vegetated with trees, which makes access to the ditch difficult. The stream bed itself is currently the only access corridor along the length of the ditch. There is no access or haul road adjacent to the ditch that can be used for material hauling after excavation.
- Monroe Ditch Sediment Remediation. Remediation of Monroe Ditch will include its western bank where the MDA-33S containment and treatment system is to be constructed. The design of MDA-33S containment and treatment system and the Monroe Ditch remediation have been coordinated. Implementation will be sequenced to accommodate necessary equipment, prevent duplication of efforts, and minimize re-contamination.

6.1.2 Design Strategy

The MDA-33S remediation design is based on bypass pumping the base flow up to a design flow level of Monroe Ditch. This allows additional access to the MDA-33S area from the ditch and the access/haul roads described in Sections 5.5.2. During remedy construction, the area around MDA-33S will be dewatered to allow construction to occur in as dry conditions as possible. The construction will be closely coordinated with the remediation of the western bank of Monroe Ditch at the proposed location of the MDA-33S containment and treatment system. The design of MDA-33S Remediation and the

Monroe Ditch excavation have been coordinated. Implementation will be sequenced to accommodate necessary equipment, prevent duplication of efforts, and minimize re-contamination. The design bases are discussed in detail in Section 2 for the following key remedial elements for installation of the groundwater containment and treatment system:

- Mechanical excavation of adjacent soils and sediment will be completed in the dry;
- Bypass pumping will be used to reroute Monroe Ditch flow around the work area;
- Groundwater will be controlled with a well point dewatering system;
- Contact construction water and groundwater will be pumped to a wastewater pretreatment system;
- Containment and treatment system will be constructed; and
- Excavated materials will be loaded into appropriately prepared trucks and hauled to landfill based on PCB concentration.

6.1.3 Flow into Containment System

Groundwater flow into the containment system is expected to come primarily from a sand layer that is approximately two feet thick and is present at depths varying between two and four feet below grade at the western bank of Monroe Ditch. Site boring logs indicate this sand layer contains NAPL and has a clay layer below it that acts as a lower confining layer and has clay above it that does not appear to transmit significant water. A geological cross-section of the MDA-33S area is shown in Attachment 2, which also includes the proposed containment barrier system and associated pipe profile.

The groundwater flow rate into the containment system was estimated using the standard Darcy equation (Bouwer 1978) for two-dimensional groundwater flow applied to the sand layer, with the assumption of no flow from the surrounding clay layers. This equation provided the estimated flow per linear foot into the containment area. The total flow was then obtained by multiplying this value by the entire length of the containment area. The hydraulic conductivity of the sand layer was estimated at 20 feet per day (ft/day), which is typical for this type of sand. The site gradient was estimated at 0.05 feet per foot (ft/ft) based on local groundwater elevation contours. Under these conditions, groundwater flow in the 2-foot thick sand layer towards Monroe Ditch and into the 500-foot long containment system was estimated at 0.01 cfs (5.2 gpm). These calculations are summarized in Table 6-1. The groundwater flow could be more or less than this amount as site conditions and the groundwater flow regime are not fully characterized yet. The design accounts for potential variability in influent flow by incorporating a safety factor into the design of the various components.

The NAPL flow rate into the containment system is expected to be very low. Experience at other sites has shown that the rate of migration of thin layers of NAPL is very slow due to NAPL viscosity and surface interactions with the matrix of the water-bearing zone.

The long-term rate of NAPL flow toward Monroe Ditch and into the containment system will not be increased beyond current flow rates since site hydraulic gradients and mechanisms which control NAPL flow toward the ditch upgradient of the containment system will not change. The containment system will intercept NAPL as it flows toward Monroe Ditch, but it will not increase NAPL flow toward the ditch. There may be a short period of greater NAPL recovery immediately after installation of the containment system, but long-term NAPL recovery is expected to be low.

6.1.4 Groundwater Quality

The groundwater quality in the containment area is summarized in Table 6-2. Low levels of PCBs were detected at a few wells during sampling and analysis in July 2007. More recent sampling and analysis did not detect PCBs. The recent sampling may indicate that PCB levels measured in groundwater could be due to the presence of suspended solids and sediment or NAPL micro-droplets in groundwater and suggests that the actual dissolved phase concentration of PCBs may be very low. The average concentration of PCBs detected from the two time periods is approximately 1.89 micrograms per liter (μg/L).

Total petroleum hydrocarbons (TPH) have also been detected in groundwater. The light fraction hydrocarbons, represented by C_6-C_{12} range, have been detected at an average concentration of approximately 7 milligrams per liter (mg/L), and the heavy fraction, represented by C_{10}-C_{20} hydrocarbons, have been detected at an average concentration of approximately 1 mg/L. Total organic carbon (TOC) was detected at an average concentration of 60 mg/L, and chemical oxygen demand (COD) at an average concentration of 257 mg/L. Low levels of ammonia, nitrate/nitrite, and some dissolved iron and manganese were also detected. There are also slightly elevated levels of total iron present, which may be due to turbidity (soil particles) in the samples. The relatively high TOC and COD levels indicate there is likely a lack of dissolved oxygen in the groundwater and reducing conditions may be predominant.

6.2 Remediation Design

The proposed system will be similar to a funnel and gate style groundwater remediation system that "funnels" or directs the impacted groundwater toward openings or "gates" in the physical barrier. The gates are configured as treatment cells that collect and contain NAPL and treat contaminants dissolved in groundwater as these fluids flow through under existing site gradients. The NAPL will be separated from groundwater in the treatment cells. Any PCBs dissolved in groundwater will be removed with granular activated carbon (GAC), which will be changed out and replaced as needed.

The southern end of the system will be adjacent to Soil Boring MDA33S-S400, with the northern end adjacent to Soil Boring MDA33S-N100. The northern and southern extents of the system were determined based on the groundwater sample results, the presence or absence of NAPL staining, and organic vapor levels measured in soil samples and recorded in the soil boring logs. The location and layout of the proposed system is shown in Attachment 2. Materials and equipment required for this design are presented in Table

6-3. The proposed system will collect NAPL and shallow groundwater flowing east from the landfill, and direct it through the two treatment cells for removal of NAPL and PCBs dissolved in groundwater. The treated groundwater will then discharge through gates and be re-infiltrated into a stone-filled gabion wall installed just to the east of the physical-hydraulic barrier and adjacent to Monroe Ditch. Infiltration of treated groundwater into the gabion wall on the down gradient side of the barrier allows treated water to remain in the groundwater system and the local watershed of Monroe Ditch.

6.2.1 Hydraulic and Physical Containment Barrier

The hydraulic and physical containment barrier proposed for this system consists of a trench to intercept NAPL and groundwater, with physical liners below and on the eastern side of the trench to direct these fluids to the two treatment cells. This system will be installed along the western bank of Monroe Ditch, between the ditch and the closed landfill, as shown in Attachment 2. The physical liners and collection pipes will be located at the western edge of the existing channel of Monroe Ditch, and the channel for Monroe Ditch will be shifted to the east (Attachment 2).

The collection trench provides a hydraulic barrier to flow by collecting groundwater along its upstream side and funneling the groundwater into two treatment cells and then through discharge gates. This allows for a long physical barrier with small effluent gates while maintaining existing groundwater gradients. The collection trench also collects NAPL along its upstream side and directs it into the two treatment cells where it can be periodically removed.

The collection trench and liners will be installed concurrent with the remediation work on this portion of Monroe Ditch, while this area is excavated and exposed. Installation of the physical-hydraulic barrier during sediment removal allows for installation of the physical flow barrier across the NAPL-impacted sand layer. The collection trench will direct NAPL and groundwater to treatment cells that will remove NAPL and treat the groundwater before discharging to an infiltration area on the eastern side of the containment barrier and adjacent to Monroe Ditch. The cross sections of the collection trench and liner system at various locations along the 500-foot long targeted containment area of Monroe Ditch are shown in Attachment 2.

6.2.1.1 Collection Pipes

The collection trench will contain two, 4-inch diameter, slotted, collection pipes; one at the base for NAPL collection and transfer and one toward the top for groundwater transfer. The collection pipes will be HDPE, sized at SDR-11. The slot size for the collection pipes is 0.1 inch wide, with each slot 2.25 inches long, with the center of each slot located at 45 degrees (45°) below the center line of the pipe, with spacing between each slot of 0.75 inches; no slots are present on the top half of the pipe. The size and number of slots provides an open area on the bottom of the pipe of approximately 17% and a total open area of approximately 8.5%. These collection pipes will transfer the liquids to two treatment cells to limit potential head loss and the need for steep gradients to move groundwater through the treatment cells.

The collection pipes are sloped to the treatment cells at approximately 0.5%, for a total drop over the 500-foot length of the containment system of 2.5 feet. This slope closely follows the slope of the lower confining clay layer over most of the length of the containment system. A profile of the collection pipes is shown in Attachment 2.

Access cleanouts for the collection pipes will be provided by installation of 45° Y-connections on the collection pipes approximately every 75 to 100 feet. These provide a point to access and clean the pipe should the collection pipes foul or become clogged over time. The locations of the cleanouts are presented in Attachment 2.

6.2.1.2 Pipe Bedding and Filtration

The slotted HDPE pipes in the collection trench will be placed within a bed of pea gravel, sized approximately 1/8 inch to 1/4 inch in diameter, to provide a permeable zone around the collection pipes. The pea gravel will also be partially surrounded with a geotextile filter fabric, which will be placed between finer grained sediment and the pea gravel. The geotextile will not be placed between the impacted sand layer and the pea gravel to ensure good hydraulic connection between the two materials. The geotextile will also be placed below the collection pipe and immediately above the linear low density polyethylene (LLDPE) liner to protect the liner from damage by the pea gravel. The geotextile selected is non-woven, needle-punched fabric, 8 oz per square yard, with an estimated water flow rate of 110 gallons per minute per square foot (gpm/ft^2). The placement of these materials is shown on the cross sections in Attachment 2.

6.2.1.3 Liner System

The physical containment barrier system will incorporate plastic membrane liners, which will be tied into the underlying clay layer to catch and collect NAPL and groundwater from the permeable sand layer. Two LLDPE liners, each of 30 mil (0.75 mm) thickness, will be placed horizontally in the lower confining clay layer at an elevation just below the base of the impacted sand layer. These liners will collect dense NAPL and provide a physical barrier to prevent NAPL flow toward Monroe Ditch. The LLDPE liners will be installed just above a layer of granular bentonite placed as needed to seal the lower clay layer where it has been excavated and allow for a curved, contoured surface to promote flow of dense NAPL into the collection pipe. A geotextile fabric will be placed above the liner to protect it from damage from the overlying pea gravel pipe bedding stone.

A vertical, rigid, 120 mil (3 mm) thick HDPE liner will be installed just to the east of the collection pipes to stop flow toward Monroe Ditch. A geotextile fabric will be attached to one side of the rigid liner to provide liner protection against coarse gabion stones of the gabion wall which will be installed just to the east of the vertical liner. The base of the vertical liner will be set into the clay layer and sealed with granular bentonite. The top LLDPE liner of the two LLDPE liners will be extended up to the top of the gravel pipe bedding around the collection pipes and be seamed to the vertical rigid HDPE liner. The rigid vertical HDPE liner will extend approximately one foot above where the two liners are seamed together. The western edge of the two LLDPE liners will be placed on the clay layer just below the contact between the impacted sand layer and the lower clay confining layer. A 30 mil LLDPE liner will also be used above the collection trench to limit the infiltration of surface water into the trench. The liner system construction details are shown on the containment system cross sections in Attachment 2**.**

Pipe penetrations of the HDPE pipe through the liner system will be sealed with an HDPE "boot" that surrounds the pipe with a round piece which is welded to the pipe and flange piece at 90° which is welded to the liner.

At the south and north ends of the containment system the vertical liner will turn approximately 90° and tie into the landfill forming "wing-walls" as termination points for the liner system. These will act to collect water from the targeted area and prevent water moving around the physical barrier in the case of a rise in water levels in the collection and treatment systems. The locations of the wing-walls and the construction details are shown in Attachment 2.

The liners will tie into the treatment cell by welding the liners to the exterior of the treatment cell. The treatment cell, to be discussed in subsequent sections, will be a pre-cast concrete vault and will have an HDPE liner cast into the exterior of the vault. Both the LLDPE flexible liners and the HDPE rigid liners can therefore be welded to the exterior of the treatment cell. The details on the tie-in of the liners to the treatment cells are presented in Attachment 2.

6.2.1.4 Gabion Wall

A stone gabion wall constructed with multiple one-foot tall gabion wire mattresses will be installed to support and protect the containment system. The gabion wall will also contain the perforated HDPE pipe for infiltration of the treated water effluent from the treatment cell. The gabion wall will use 4-inch to 8-inch diameter stones and will be installed just to the east of the vertical rigid liner where the existing Monroe Ditch channel is currently located. The Monroe Ditch channel will be shifted approximately 9 to 12 feet to the east and the eastern bank cut and sloped to tie-in the slope between the new channel and the existing grade. The locations of the gabion wall, existing and new Monroe Ditch channel locations, and cross sections with additional construction details are shown in Attachment 2.

6.2.2 Excavation and Fill Volumes

Installation of the containment system will occur during the excavation of the impacted sediment and soil from Monroe Ditch. Some additional soil will be removed beyond the sediment directly under the existing channel to allow for the installation of the containment system and the relocation of the Monroe Ditch channel further to the east. Granular materials such as the pea gravel used for pipe bedding stone and the gabion stone will be added to the area and will need to be imported. An estimate of the volumes of materials to be imported and disposed is included in Table 6-4.

6.2.3 Treatment Cell

The collection trench and associated piping will transfer the groundwater and NAPL from the edge of the western landfill to the two treatment cells, which will remove NAPL and treat the groundwater using activated carbon to remove potentially dissolved PCBs. The proposed locations of these cells are shown in Attachment 2. Flow of treated water from the cells would be directed into an infiltration pipe located to the east of the vertical liner system constructed within the gabion wall. Treated water flow from the southern-most cell could also be directed back into the treatment trench instead of the infiltration area if additional treatment is needed. A process flow diagram for the treatment cell and the expected operations, monitoring, and maintenance requirements associated with the cell are presented in Attachment 2.

The treatment cell will be constructed from a pre-cast concrete vault with an exterior HDPE liner cast into it to allow for welded tie-ins of the other liners to it. The treatment cell will be outfitted with various components, partitions, and baffles for use as an oil/water separator and to hold GAC units. Four isolation valves will be used to shut off water to the cell and allow for the cell to be pumped out for carbon change-outs or other maintenance as needed. Monitoring points will be located throughout the various sections of the cell to track the accumulation of NAPL and sediment in the base of the cell and to allow for sample collection for performance monitoring. A fiberglass grate floor will be installed to allow the operator access to the monitoring points and cell internals. The floor will be below the top of the cell to allow access without confined space issues. The top of the cell will have a double door for access. A plan view and section view of the long axis of the treatment cell are shown in Attachment 2.

The two primary treatment components, the oil/water separator and the GAC units, are described in the following sections.

6.2.3.1 Oil/Water Separation

Each treatment cell would contain NAPL removal and collection components consisting of: (1) an initial separation area (ISA) for gravity separation of NAPL and settling of particulates; and (2) coalescing media (CM) for oil/water separation. The oil/water separator flow path and CM is configured in a double labyrinth style pattern to increase the flow path length in a limited space. The ISA has a total volume of 309 gallons and provides a residence time of 59 minutes for gravity separation of NAPL droplets and particle settling. The ISA has both upper and lower baffles to screen off both dense NAPL and light NAPL. The lower baffle at the exit of the ISA for dense NAPL is one-foot tall and allows for the accumulation of up to 44 gallons of dense NAPL. The upper baffle at the exit of the ISA is nine-inches below the estimated static water level in the cell and provides for the accumulation of up to 33 gallons of light NAPL; light NAPL is not expected to accumulate beyond more than a sheen.

Water flows through the exit baffles of the ISA and into the CM passing through an open area to help distribute flow across the CM. The CM is a plastic media with a high surface area (e.g., 132 square feet per cubic foot [ft^2/ft^3]) made for horizontal flow in oil/water separators and is capable of vertical settling of dense NAPL and particulates. The high surface area promotes coalescing of free product droplets and promotes settling of solids, and the open vertical spaces allow for separation of both dense and light NAPL. The maximum loading recommended for this media is approximately 12 gpm/ft^2. At the expected maximum flow rate of 0.01 cfs (5.2 gpm) the design loading into the CM is 0.43 gpm/ft^2 , which allows for a safety factor of 28 times below the maximum recommended loading rate for this media. Flow through the media could increase significantly and still be less than the maximum recommended loading rate. These design and operational parameters for the oil/water separator are summarized in Table 6-5.

The CM area also has lower and upper exit baffles to trap dense and light NAPL and allow for the accumulation of NAPL and solids which may settle within the CM. The bottom baffle is a two-foot tall concrete wall and provides a 60 gallon sump volume for dense NAPL and settled solids. The upper baffle is an adjustable baffle to allow for collection and removal of light NAPL, if present, from the system. The baffle is adjustable to allow for variations in groundwater levels. Construction details and the plan and section views of the treatment cell and associated internals and baffles are shown in Attachment 2.

Monitoring of NAPL or settled solids that accumulate in the treatment cell within either the ISA or the CM areas would be monitored using oil/water interface probes lowered through the two-inch diameter monitoring pipes in these two areas. Accumulated NAPL will be removed periodically by pumping from each of these areas as needed. Each area also contains a one-inch diameter underdrain with slotted openings at the base to pump out these areas.

Water from the CM area will then flow through a turbidity curtain to remove suspended solids and turbidity prior to treatment with activated carbon. The turbidity curtain will consist of a filter fabric cloth with 100 micron rated openings secured within a removable frame to allow replacement of the filter fabric. Removing turbidity at this point helps protect the carbon units from fouling with solids, and also removes suspended solids which may contain adsorbed PCBs. The turbidity curtain also promotes flow distribution across the entrance area of the activated carbon units that follow.

6.2.3.2 Activated Carbon Treatment

Activated carbon treatment to remove dissolved PCBs within the treatment cell will follow oil/water separation and the turbidity curtain. Activated carbon adsorption has been shown to be an effective treatment for PCBs due their low solubility and tendency to partition into organic phases. Other organics may be present in the groundwater which may compete with PCBs for adsorption sites on the carbon. These other organic compounds may be petroleum hydrocarbons from NAPL or dissolved organic matter from degradation of organic materials.

Activated carbon usage rates for PCBs were conservatively estimated using adsorption isotherms (USEPA 1980) established from batch tests and a PCB concentration of 0.008 mg/L, which is the maximum detected to date (0.00786 mg/L). In addition, carbon usage from TPH was also estimated with the average TPH concentration of 8 mg/L. The adsorption isotherms and estimate of the carbon usage rates are presented in Table 6-6. The estimate indicates a carbon usage rate of approximately 10 lbs/day under the conditions noted and at a flow rate of 0.01 cfs (5.2 gpm). The low effluent treatment requirement for PCBs lowers the adsorption equilibrium on the carbon and drives up the carbon usage even though the mass of PCBs to be removed is small. Effective oil/water separation may lower the TPH concentration further, resulting in lower usage of activated carbon.

The carbon units are sized to minimize the number of change-outs each year while also fitting into the treatment cell pre-cast concrete vault. Three carbon units in series are configured with about 3,360 pounds per unit, but with only about 2,665 pounds submerged per unit at existing static water levels. It would take approximately 278 days for a single carbon unit to be used up at the estimated usage rate of 10 lbs/day. Monitoring points are located between each of the carbon units so effluent water quality can be tracked before and after each carbon unit.

Each carbon unit utilizes the side walls and floor of the treatment cell vault to support carbon and removable flow-through partitions constructed of stainless steel angle iron, mesh, and screen. The space between the flow-through partitions would be filled with carbon, and the water would be treated as it flowed through. The construction details for these partitions and associated support items are presented in Attachment 2.

The carbon units were configured with the large entrance area to minimize pressure drop across each unit by lowering the water velocity into each unit. Each unit has a cross-sectional area of approximately 46.5 feet, and the water velocity into the unit at 0.01 cfs (5.2 gpm) is only 0.112 gpm/ft^2. The estimated pressure drop at this flow rate across the 1.83 foot bed depth is estimated at 0.18 inches of water column or 0.55 inches of water column for all three of the beds. The empty bed contact time (EBCT) for each bed at the 0.01 cfs (5.2 gpm) flow rate is approximately 123 minutes. The typical EBCT required for adsorption equilibrium is 10 to 20 minutes, so the bed provides a safety factor of 6 to 12 times the typical EBCT criteria. A summary of the carbon sizing and operational parameters is presented in Table 6-7.

A second turbidity curtain will be installed after the third carbon bed to remove turbidity and prevent activated carbon particles from exiting the treatment cell. This turbidity curtain would be most important during change out of the carbon when the carbon beds are stirred up.

6.2.4 Infiltration Area

An infiltration area for the treated groundwater will be installed on the eastern side of the hydraulic and physical barrier to allow treated water to be returned to the Monroe Ditch watershed under existing site hydraulic gradients. The infiltration area will utilize the stone gabion wall that supports part of the physical barrier as a large infiltration gallery. The infiltration area will return the water to the Monroe Ditch water shed through a perforated pipe that is set within the gabion wall. The perforated pipe will be an HDPE, SDR-11 pipe with perforation sizes of 0.625 inches in diameter and a hole pattern of four holes centered at 90° around the pipe with a center to center spacing between patterns of 1.5 inches and a rotation offset of 45° between hole patterns. This pattern allows water to move out from the pipe in all directions. The location of the infiltration area is shown in Attachment 2, and is the space between the barrier and edge of Monroe Ditch. The structure of the infiltration area is shown in Attachment 2. The flow of treated water from the southern-most treatment cell could either be directed back to the collection trench for additional treatment in the second treatment cell, or be discharged into the infiltration area to the east. The northern-most treatment cell discharges back into the infiltration area.

6.2.5 Sentinel Wells

Two sentinel wells will be installed and developed following the installation of the groundwater containment and treatment system. The wells will be located approximately 10 feet from the north and south ends of the containment system. The sentinel wells will be installed such that the bottoms of the well screens tie into the top of the underlying clay layer. Wells will be constructed and monitored in accordance with the design drawings (Attachment 2) and *MDA-33S O&M Plan* (Attachment 4).

6.2.6 Work Sequencing

The MDA-33S containment system will be installed concurrently with the removal of the Monroe Ditch sediment, with the containment system built as the sediment is removed. The general sequence of construction will be completed in accordance with the following sequence:

- Construction of the two precast concrete treatment cells configured as indicated on the design drawings, with internal components such as partitions, weirs, top grating, access doors, treatment media, valves, pipe penetrations, and external HDPE liner;
- Construction of work areas to allow access, construction, and installation of the treatment cells, liners, vertical liner barrier, backfill materials, and all other components of the MDA-33S Containment System at Monroe Ditch;
- Installation of a dewatering system for shallow groundwater west of the MDA-33S containment area with a well-point style dewatering system needed for recovery and containment of excavation waters and associated operation and maintenance for the duration of the MDA-33S construction (Attachment 2). Details of the construction dewatering well point system are summarized in Table 6-8 and are shown on the drawings. Extracted groundwater will be pre-treated at the MDA-33S treatment system (Attachment 2). The pre-treated MDA-33S groundwater is then considered to be construction contact water and will, therefore, be treated at the on-site water treatment system prior to disposal in Dicks Creek as described in Section 4.2.6. Additional monitoring may be required if specified in the NPDES permit;
- In areas where the containment system will not be installed, excavate Monroe Ditch sediment and use excavated Monroe Ditch channel as haul road;
- In areas where the containment system will be installed, excavate east side of Monroe Ditch at new channel for use as temporary haul road for removal of impacted ditch sediment;
- Following the excavation of impacted sediment in Monroe Ditch at the south end, begin to install the lower portion of the gabion wall at the south end of the containment system to allow for shoring and stabilization of the western side slope for installation of horizontal and vertical containment liners;

- Complete final excavation, cut into the western bank, and install liners, collection pipe, pipe bedding pea gravel, and geotextiles in and around collection trench;
- Complete gabion wall and backfill with suitable soil, continue to work to the north installing the remainder of the system, and install treatment cells at locations shown21;
- Completion of the final backfill and grading above the collection trench, installation of the haul road, and final grading to meet the grades and elevations shown on the drawings;
- Removal of temporary dewatering system;
- Installation of sentinel wells; and
- Restoration of Monroe Ditch as described in Section 7.

6.3 Disposal of Excavated Material

Excavated materials will be handled as described in Section 5.3. The contractor shall comply with all applicable federal, state, and local regulations regarding handling, stockpiling, and transporting materials.

6.4 Site Preparation

6.4.1 Staging Areas

Staging areas will be used for equipment storage, limited material storage and rehandling, and dewatering of the excavated material, if needed. Staging Areas 1 and 2 (described in Section 4.4.1) will be the primary staging areas for remediation activities associated with MDA-33S. Following project completion, Staging Area 2 will be sampled (as specified in Attachment 1) to confirm that the underlying material was not contaminated during construction.

6.4.2 Access and Haul Roads

The MDA-33S containment system construction will use the Monroe Ditch remediation access/haul roads (Figure 4-1 and Attachment 2). During material transport, dedicated haul roads within the slag processing area will be delineated. Trees, brush, and other vegetation will be removed as required to access the work area.

The haul road adjacent to MDA-33S will be approximately 12-feet wide and will be constructed of aged slag (or equivalent) or aggregate (2.5 inches or smaller). The haul road sub base will be prepared by removing vegetation and soft, unstable soils. The

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[21] The Permit to Install issued for the MDA-33S groundwater containment and treatment system will require Ohio EPA's inspection of the system.

prepared surface will be proof rolled and compacted as necessary. Depending on subsurface conditions, access roads may be constructed using 8 oz non-woven geotextiles or geogrids necessary to stabilize soft areas. Geotextiles and geogrids will be overlain with a minimum 4 inch lift of compacted slag of a gradation suitable for the application. Lift thickness and material gradation may be adjusted as necessary to ensure a stable road base is constructed. The access road adjacent to the MDA-33S groundwater containment and treatment system will remain in place to support future operations and maintenance activities.

6.4.3 Soil Erosion Control

The SWP3 for Monroe Ditch (Section 4.4.3) will include MDA-33S remediation activities.

6.4.4 Decontamination Areas

The project controls and decontamination processes described in Section 4.4.4 will be used for the Monroe Ditch remediation implementation.

6.5 Mobilization and Demobilization

The mobilization and demobilization activities are described in detail in Section 4.5 covering both Dicks Creek and Monroe Ditch.

6.6 Permits

No access agreement will be required because MDA-33S remedial activities will occur on AK Steel property. IM 3 may require the following permits:

- Ohio EPA NPDES permit and a PTI for the water treatment and discharge system;
- Notice of Intent for coverage under the Ohio EPA General Construction Activity Storm Water Permit;
- Ohio EPA Air Permit to Install and Operate; and
- An AK Steel dig permit for excavation on AK Steel property. In addition an AK Steel confined space entry permit will be required for anyone who enters the excavation hole(s).

Ohio EPA has determined that certification pursuant to Section 401 of the Clean Water Act is not required.

7.0 RESTORATION

Following the remediation of both Dicks Creek Reach 1 and Monroe Ditch, additional work will be conducted under IM 8 to restore the floodplain of Dicks Creek and the two channels. For Reach 1, restoration work will involve constructing a template for a new floodplain and channel. In Monroe Ditch, restoration work will focus on rebuilding a new channel bed and new channel banks.

7.1 Design Basis

7.1.1 Dicks Creek Reach 1

The restoration approach for Reach 1 makes use of natural sedimentation processes along with a more sinuous constructed-channel template consisting of low floodplain benches and floodplain weir riffles as presented Attachment 2. The basis for this approach is the past history of Reach 1; historical aerial photography shows the evolution of the existing channel following a major realignment and channelization that occurred circa 1966. The Miami Conservancy District constructed a wide and generally flat flood-control channel confined within constructed berms. Based on an evaluation of the aerial photography, it is evident that natural sedimentation formed a smaller channel within the berms similar to the existing channel within a few years and that the existing channel has changed very little since approximately 10 years following channelization. Based on this information, it is likely that the stream's natural processes are capable of building a channel and creating an overall higher quality restoration than other methods. For example, the floodplain soil material, permeability, and structure are all important variables for a healthy riparian system and would be difficult to construct properly. By taking advantage of natural processes, stream restoration would be more efficient and sustainable. To assist the natural processes, the restoration work includes the formation of a more sinuous shallow channel that will act as a template for the restored stream.

In addition, floodplain riffle/weir structures, constructed of substrate material, larger rock, and graded berms, will be built across the entire Dicks Creek channel to promote the formation of a floodplain through the deposition of fine sediment and to provide riffle habitat made of coarser sediment in the channel. The drawings (Attachment 2) present the proposed contours, pool water level, structure locations, proposed thalweg of the stream, upstream and downstream tie-in points, and the location of the proposed riffle/weir structures. The installation of various types of woody debris on the low bench will aid in deposition and improve aquatic habitat. These include large woody debris bundles, standing snags, and brush dikes. A critical component of this project is the establishment of native vegetation. Non-native invasive plant species currently dominate the floodplain of Reach 1 and will be an on-going management challenge. Live stakes that can thrive in a more dynamic and wetter environment will be installed on the low bench and containerized trees and shrubs will be installed higher up on the edges of the low bench and on the berms. By installing native vegetation immediately after construction, they will have the opportunity to become established before nearby invasive species fill in. The plantings will need to be monitored as the floodplain accumulates sediment and vegetation grows and becomes established.

The restoration work in Reach 1 will follow remediation activities and will begin only once the excavation in that grid cell is considered complete. The relation between restoration and remediation activities in Dicks Creek is discussed in Section 4.2.9. The water diversion used for the sediment excavation will stay in place for the restoration work.

7.1.2 Monroe Ditch

Following remediation of Monroe Ditch and the installation of the MDA-33S groundwater containment and treatment system, Monroe Ditch will be restored. The restoration design of Monroe Ditch is based on a bankfull channel design with constructed riffles made of substrate material, pools, and stabilization structures consisting of rock and logs. The drawings show alignment and stationing of the proposed channel of Monroe Ditch on top of the existing conditions basemap (Attachment 2). In addition, the drawings show the proposed contours, bankfull limits, proposed thalweg, tie-in points, and the location of the proposed constructed riffles, log vanes, and rock grade control structures.

Woody structures will be installed for both bank protection and in-stream habitat improvement. As with Dicks Creek, the establishment of native vegetation is important. Containerized trees and shrubs will be installed along the stream and further up the steeper valley slopes. The restoration design took into account the design elements required for MDA-33S (IM 3), the interceptor trench located near the stream (IM 9), the existing culvert on Monroe Ditch, and the sheetpile barrier associated with groundwater seeps 11/12.

The restoration work in Monroe Ditch will closely follow the remediation activities. The relation between restoration and remediation activities in Monroe Ditch are discussed in Sections 5.2.8. The water diversion used for the sediment excavation will stay in place for the restoration work.

7.1.3 Design Constraints

The restoration design works around several significant design constraints. For Dicks Creek Reach 1, it was determined early on that the restoration could not extend beyond the levees due to property ownership. As a result, the restoration design has to work inside the channelized footprint of the stream, which limits the size of the riparian corridor and associated ecological benefits. Monroe Ditch also has considerable physical constraints due to existing surrounding land use. The existing landfills, interceptor trench, and ground elevations limit both the existing and potential channel sinuosity. The MDA-33S containment and treatment system further constrains the location of the proposed channel. As a result, the design focuses on re-constructing riffle/pool bed features with minimal meandering.

7.1.4 Important Restoration Design Components

The drawings (Attachment 2) and specifications (Attachment 1) describe the restoration design and associated components in detail. Important components include the following:

- Substrate material used in the floodplain riffle/weirs and constructed riffles;
- Rock used for floodplain riffle/weirs, rock grade control, and anchoring log toe protection, log vanes, and rootwads;
- Logs used for log toe protection and log vanes;
- Channel subgrade material and channel material from off-site sources used to provide a clean layer of material on the bottom of the pools of Dicks Creek and Monroe Ditch;
- Floodplain soil from off-site used to provide a clean layer of material on top of the low benches along Dicks Creek;
- Topsoil furnished from off-site for planting areas;
- Live stakes and live branches; and
- Trees, shrubs, and permanent seeding.

The restoration will be implemented using a variety of equipment (Table 7-1) including bulldozers, a low ground pressure loader/excavator, and small load low ground pressure dump trucks.

7.2 Site Preparation

Staging areas, access/haul roads, and soil and erosion controls from the floodplain soil and sediment remediation (Sections 4 and 5) will be used for the restoration activities. Therefore, no additional site preparation is necessary.

7.3 Permits

No additional permits are necessary for the restoration of Dicks Creek Reach 1 and Monroe Ditch.

8.0 CONSTRUCTION QUALITY ASSURANCE

The quality assurance program (Attachment 9) will include a component to test the quality and engineering properties of the work to ensure that the performance standards are achieved. The contractor will be ultimately responsible for any additional work needed due to failure to achieve performance standards. Any data collected will follow the procedures and specifications set forth in the *Interim Measure Quality Assurance Project Plan* (ENVIRON 2006b) and the *Interim Measures Data Management Plan* (ENVIRON 2006e).

The *Interim Measure Quality Assurance Project Plan* (ENVIRON 2006b) addresses the procedures necessary to document sampling, field measurements, and sample analyses performed and includes a description of quality assurance objectives and data reduction and reporting requirements. Data records, inspection logs, analytical laboratory reports, and chain-of-custody documentation will be reviewed for accuracy and completeness, assuring adherence to high scientific and technical standards.

Data records will be reviewed for accuracy and completeness. The *Interim Measures Data Management Plan* (ENVIRON 2006e) describes the project; project organization and responsibility; and data reporting, tracking, and security associated with the IM 2, IM 4.C, IM 6, and IM 8 remediation, including field data and geospatial data

The ENVIRON Project Manager or designee will provide oversight of the contractors throughout the IMs implementation. This will include general inspection of all work and the rejection of any work that does not meet the technical specifications of the project. The ENVIRON Project Manager or designee will ensure that all measures are installed correctly and in the proper sequence. Weekly reports of the construction progress and any problems encountered will be provided. Daily inspection data sheets will be kept on file at the on-site project offices. Periodic audits of the IMs implementation will also take place to confirm that a high level of quality is maintained throughout the project.

9.0 OPERATIONS, MAINTENANCE, AND MONITORING

Once construction is completed for each IM, all continued operations, maintenance, and monitoring will continue, as necessary, under the related *MDA-33S Containment System Operations and Maintenance Plan* and *Restoration of Reach 1Dicks Creek, Monroe Ditch, and Outfall 002 Operations and Maintenance Plan* (Attachment 4). Details of the Operation & Maintenance methods, contingency actions, and schedules are provided in Attachment 4.

10.0 PROJECT MANAGEMENT

The project management team consists of:

- AK Steel: Owner;
- ENVIRON: Lead Consultant and construction oversight;
- DOF: Sediment and soil remediation design and technical oversight;
- IESI: MDA-33S Area design and technical oversight; and
- Biohabitats: Stream and floodplain restoration design and technical oversight.

Figure 10-1 presents the organization chart for the project management team. AK Steel and ENVIRON, have overall responsibility for and management of the project, relying on DOF, IESI, and Biohabitats for the design and technical oversight of their respective pieces of the work. DOF has responsibility for sediment and soil remediation (IM 2, IM 4.C, and IM 6). IESI has responsibility for the MDA-33S remediation (IM 3). Biohabitats has responsibility for stream and floodplain restoration (IM 8). The technical staff for this project will be drawn from the project team's pool of resources and as necessary, qualified subcontractors. The technical staff will be utilized to monitor construction activities, gather and analyze data, and prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence to effectively and efficiently perform the required work.

Specific individuals will be designated to each responsibility upon implementation of the project. Management responsibilities, including the AK Steel Project Coordinator, AK Steel Project Manager, ENVIRON Project Manager, and Engineers and Technical Managers are described below.

10.1 Project Management Team

10.1.1 AK Steel Project Coordinator

The primary function of the AK Steel Project Coordinator (Carl Batliner) is to ensure that technical, financial, and scheduling objectives are achieved successfully. The Project Coordinator will approve all external reports (deliverables) before their submission to United States et al.

10.1.2 AK Steel Project Manager

The AK Steel Project Manager (Kurt Hileman) is responsible for implementing the project and has the authority to commit resources necessary to meet project objectives and requirements. The AK Steel Project Manager will work directly with the ENVIRON Project Manager to monitor and direct daily activities; communicate health and safety information to project personnel; serve as a liaison between ENVIRON, the remediation contractor, regulatory personnel, and the AK Steel Project Coordinator for IM 2, IM 4.C, and IM 6. The AK Steel Project Manager will work directly with ENVIRON Project Manager and Biohabitats Project Manager for IM 8.

10.1.3 ENVIRON Project Manager

The Environ Project Manager (Tim Barber) has responsibility for ensuring that the project meets the objectives of United States et al.'s and ENVIRON's quality standards. The ENVIRON Project Manager will report directly to the AK Steel Project Manager.

10.1.4 Subcontractors

10.1.4.1 DOF Technical Manager

The DOF Project Manager (Robert Webb, PE) or his designee will assist with ensuring that the project design for sediment and soil remediation meets the objectives of United States et al. and that the soil and sediment remediation meets the specifications quality/performance standards for IM 2, IM 4.C, and IM 6. The DOF Project Manager will report directly to the ENVIRON Project Manager.

10.1.4.2 IESI Site Construction Engineer

IESI will provide a Site Construction Engineer (David Falatko, PE) to be on-site during the construction of the MDA-33S containment and treatment system. The Site Construction Engineer will approve materials for use in the construction of the containment system (along with the ENVIRON Project Manager) and will ensure that the project design for MDA-33S area remediation meets the objectives of United States et al. and that the remediation meets the specifications quality/performance standards for IM 3. The IESI Site Construction Engineer will report directly to the ENVIRON Project Manager.

10.1.4.3 Biohabitats Restoration Engineer

Biohabitats will provide a Restoration Engineer (Michael Lighthiser, PE) to be on-site as necessary during the restoration of Reach 1 of Dicks Creek and Monroe Ditch. The Restoration Engineer will approve materials for use in the restoration (along with the ENVIRON Project Manager) and will ensure that the project design for stream and floodplain restoration meets the objectives of United States et al. and that the associated restoration meets the specifications quality/performance standards for IM 8. The Restoration Engineer will report directly to the ENVIRON Project Manager.

10.1.4.4 Bridge Engineer

R.E. Warner and Associates will provide a Bridge Engineer (Jeffrey Spangler, PE) to design the new Monroe Ditch bridge structure. The Bridge Engineer will ensure that the project design for bridge structure meets the necessary quality/performance specifications. The R.E Warner and Associates Bridge Engineer will report directly to the ENVIRON Project Manager.

10.1.4.5 Civil Engineer

H.C. Nutting will provide a Civil Engineer (Aaron Muck, PE) to be on-site (as necessary) during the construction of the new Monroe Ditch bridge structure. The engineer will monitor the conformance of the construction of the bridge with its proposed design. The engineer will report directly to the ENVIRON Project Manager.

10.2 Field Responsibilities

A Site Construction Quality Assurance (CQA) Officer (to be determined) will be responsible for leading and coordinating the day-to-day activities of the various contractors working on the project. Specific responsibilities of the CQA Officer include:

- Daily coordination with the remediation contractor including progress meetings, transmitting directions and guidance from AK Steel as appropriate, and facilitating/tracking the resolution of issues as they arise;
- Providing day-to-day coordination with the respective engineer or technical manager on technical issues in specific areas of expertise;
- Implementing field related work plans, assurance of schedule compliance, and adherence to management developed study requirements;
- Coordinating and managing field activities and supervising field staff;
- Implementing Quality Control (QC) for technical data provided by field staff, including field measurement data;
- Adhering to work schedules provided by AK Steel;
- Coordinating and overseeing technical efforts of subcontractors assisting the field team;
- Identifying problems at the field team level, resolving difficulties in consultation with AK Steel Project Manager, and implementing and documenting corrective action procedures; and
- Participation in preparation of final report.

10.3 Contractor Selection

AK Steel has completed the contractor selection process for the Monroe Ditch and Dicks Creek Reach 1 soil and sediment remediation, MDA-33S remediation, and the stream and floodplain restoration in Reach 1 and Monroe Ditch. The intent of the selection process was to select a contractor that:

- Has ability to work with design team to develop final design details;
- Has the capacity to successfully complete all components of the project as designed;

– Has a commitment to AK Steel to provide qualified resources (superintendents and operators, good quality and reliable equipment, corporate sponsorship) to complete the project as designed;
– Has experience completing projects of similar nature (remediation and restoration) and complexity;
– Has a knowledgeable understanding of the project needs, along with a thorough plan to address and successfully complete all components of the project; and
– Provides good value to AK Steel (cost-efficient project completion).

The contractor selection process was initiated with a Request for Qualifications (RFQ) from AK Steel to interested potential contractors. A short list of qualified contractors was developed based on a review of their submitted qualification. Each of the short-listed contractors had the specific experience in bypass pumping, use of temporary dam structures, performing sediment remediation, performing large volume removal projects, development, installation, and operation of water treatment systems; PCB remediation experience; restoration experience; and Ohio project experience.

The short-listed contractors came to the site for a project briefing and site tour after which they prepared a detailed proposal including an approach to the work. The contractors submitted their detailed proposal to AK Steel for evaluation. Each of the short-listed contractors was then interviewed before AK Steel selected the preferred contractor and began contract negotiation. Contractor Statements of Qualifications for ENTACT, LLC and Meadville Land Service, Inc. were provided to the USEPA et al. in March 2009.

11.0 CONSTRUCTION SCHEDULE

The permit applications for all IMs discussed in this document were submitted in February 2009. The PTI, NPDES, general stormwater Notice of Intent, and PTE permit applications were submitted to the Ohio EPA. At the same time, the NWP 38 pre-construction notification was submitted to the USACE Huntington District Office.

Once access agreements are obtained and approval is received for the Design Document and permits, construction activities will begin during the next appropriate season. Construction activities shall be limited to June 1 through November 30.

See Figure 11-1 for the anticipated schedule based on the assumption that permits will be approved in time for construction activities to begin in 2009. Mobilization to the site would occur in April and May 2009. The construction work described in this Design Document is planned to start June 1 and be completed prior to November 30, 2009, not including mobilization or demobilization.

12.0 CONSTRUCTION COST ESTIMATES

The costs associated with the implementation of the *MDA-33S, Monroe Ditch, Dicks Creek Reach 1 Floodplain Soil and Sediment Design Document* are provided in Tables 12-1 through 12-4. The estimated cost for implementation is approximately $11,000,000. The estimate is broken-down into major elements of the remedial construction. A 10% contingency was added to the cost estimate to account for any unforeseen eventualities that are likely to arise during implementation.

13.0 PUBLIC INVOLVEMENT

The approved *Interim Measures Public Involvement Plan* (PIP) (ETC 2006) addresses the tools and necessary procedures to keep the public informed regarding activities associated with investigation, remediation, and restoration during the implementation of the IMs. Consistent with the *Interim Measures PIP*, the following measures will be taken.

13.1 Information Repository

An Information Repository has been established at the Middletown Public Library to ensure that site-related information is available to the public. This *Draft MDA-33S, Monroe Ditch, and Dicks Creek Reach 1 Sediment and Floodplain Soil remediation Design Document* will be available within 30 days of approval. Monthly IM progress reports will be available within 30 days of submittal. The address and phone number for the repository are provided below.

Middletown Public Library
125 S. Broad Street
Middletown, OH 45044
513-424-1251

The repository is handicapped accessible and contains photocopying capabilities.

13.2 Fact Sheets

Informational fact sheets will be prepared to communicate specific details related to IM remedial activities. These fact sheets will be one to two pages in length and will include definitions of terms and acronyms. The fact sheets will be distributed to all members of the mailing list and filed in the Information Repository. Fact sheets will be distributed within 30 days of approval by the USEPA and Ohio EPA.

13.3 Public Meeting and Availability Sessions

AK Steel will hold a public meeting to discuss the work described herein at least 30 days prior to the start of floodplain soil excavating and creek sediment dredging work. This public meeting will provide details of the design and schedule of remediation activities. In addition, AK Steel may host availability sessions during excavating and dredging implementation.

14.0 HEALTH AND SAFETY

The *Site Security Plan* (Attachment 10) and the *Interim Measures Health and Safety Plan* (HASP) (ENVIRON 2006f) addresses the potential chemical and physical hazards present at the site and includes provisions for health and safety monitoring and emergency procedures. It is anticipated that the work under IMs 2, 3, 4.C, 6, and 8 will be conducted under modified Level D personal protective equipment.

The selected contractor will be required to develop and abide to their own HASP which, at minimum, meets the requirements specified in the *Interim Measures HASP*. The contractor's HASP shall be maintained at an on-site location and in the project file. In the event that multiple HASPs are in effect during project work and the requirements are in conflict, the more conservative HASP requirement shall prevail.

All field activities in the remediation area will require that all site workers and contractors conform to AK Steel safety requirements, with respect to training, drug testing, and personal protective equipment (PPE). The USEPA and Ohio EPA staff are not subject to these requirements, with the exception of proper PPE and attendance of daily safety briefings.

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